The presence and significance of the esophageal glands in the abdominal esophagus in dog

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Summary

The present study was carried out on abdominal esophagus fragments, harvested from 5 dogs, which were brought in at the Morphopathology Laboratory for necropsy. The histological examination highlighted the presence of numerous tubuloacinar glands disposed in lobules, and surrounded by skeletal muscle bundles. The great majority of the secretory units were represented by mucous acini and sacciform units with a large lumen, which seem to temporary deposit the secretion product. These sacciform units open directly in the excretion channels, which in turn transport the content of their lumen to the surface of the esophageal mucosa. These aspects suggest that the secretion products are temporary stored and then directed to the esophageal mucosa’s surface when they are needed. Most probably, the secretion of the abdominal esophageal glands protect the mucosa from the acid pH of the regurgitated food from the stomach, a frequently process in dog.

Introduction

The esophagus is a tubular organ which allows the passage of the bolus form the pharynx to the stomach (Gal & Miclăuş, 2013) and presents three topographic regions: cervical, thoracic and abdominal (Hudson & Cummings, 1985). The wall of the esophagus presents the 4 specific layers of the digestive tract: mucosa, submucosa, muscularis and adventitia or serosa. The esophageal glands are present in the lamina propria and submucosa layers (Aughey & Frye, 2001). They are less abundant in humans and more numerous in certain animal species such as dogs and pigs (Shiina et al., 2005) and very well represented in snakes (Adlersberg et al., 1955). Some authors affirm that their number increases with age (Henk et al., 1986). The esophageal glands are not present throughout the whole length of the esophagus. Thus, in horse, ruminants and cat they are present solely in the anterior third, while in rabbit, they are completely absent (Adlersberg et al., 1955).

In animals, the degree of esophageal gland development seems to be in direct relation to the masticatory type. For example, in snakes the mastication is absent, thus the glands are very numerous and large, while in cats the mastication is thorough and the glands are small and present solely in the first third of the esophagus (Adlersberg et al., 1955). Considering the fact that the information, concerning the presence or absence of glands in the abdominal esophagus, in the specialty literature is scarce and contradictory, we considered appropriate to study the abdominal esophagus in dog from this point of view.
Material and methods

The study was carried out on 5 mm thick esophagus fragments harvested from the abdominal esophagus, while performing the necropsy at the Legal Medicine and Necropsy Diagnosis service of the Faculty of Veterinary Medicine Cluj-Napoca in 5 dogs: different breed, age and sex. The harvested samples were fixed in Stieve’s solution for 24 hours long, then dehydrated with ethanol, clarified in n-butanol, embedded in paraffin, sectioned at a 5 µm thickness and stained with Goldner’s trichrome method for contrast. The microscopic slides were examined using a light microscope (Olympus BX 41) endowed with a digital camera (Olympus E 330) and the obtained images were subsequently edited using the Adobe Photoshop CS 2 V 9.0 software.

Results and discussion

Various esophageal glands were highlighted in the abdominal esophagus in dog through microscopic examination. The glands occupy approximately two thirds (internal and middle) of the tunica submucosa thickness (Fig. 1).

The esophageal glands appear somehow grouped, with a tendency to form lobules separated by connective tissue. Here and there, the connective tissue surrounding the glands is infiltrated with striated skeletal muscle bundles, which derive from the muscularis mucosae. The bundles surround these small glandular lobules (Fig. 2).

The glands’ excretory channels are lined by a bistratified cuboidal epithelium (Fig. 3). They transit muscularis mucosae, then lamina propria and open at the surface of the esophageal mucosa.

Structurally, they are branched tubuloacinar glands. Most of the secretory units are mucous (Fig. 4), but approximately 15-20% are seromucous (Fig. 5), with a typical crescent aspect (serous demilune). The secretory mucous units are polymorph in size, with relatively large differences from one segment to the other. The relatively large lumen, present even in the smaller secretory units, suggests the fact that the esophageal glands in dog have mainly a mucous secretion type. The aspect of the secretory unit and the diameter of the lumen suggest the fact that the synthesized mucus is a viscous one. The height of the glandular cells is comparable in different sized secretory units while the lumen gradually increases in diameter as the secretory units’ size increases.
The secretory units appear elongated (sacciform) with a large lumen (dilated), which suggests that the secretion product accumulates in the lumen for a certain period of time (Fig. 6). These secretory units communicate with the excretory channels which transport the secretion product to the surface of the esophageal mucosa.

The excretory channels have a narrower lumen in comparison to the secretory unit (which deposits secretion products), which suggests that the channels only transport the products, but do not deposit them. These aspects suggest the fact that the secretion products are only temporary deposited in the lumen and intermittently eliminated when they are needed at the surface of the mucosa.

In our judgement, the presence of numerous esophageal glands in the abdominal esophagus is not necessarily linked to the mastication type of this species, but rather to the regurgitation reflex frequently present in dogs. The viscous mucus and its large amount secreted by the glands present in this area could have a protecting role for the esophageal mucosa against the acid pH in carnivore’s stomach, which is due mainly to the presence of the hydrochloric acid.
The mucous secretion in the secretory units’ lumen is almost instantaneously eliminated the moment the food is regurgitated and forms a protection barrier for the esophageal mucosa, a process which is also affirmed by other researchers (Long & Orlando, 1999; Shiina et al., 2005).

The striated skeletal muscle cells detached from the muscularis mucosae, arranged in bundles between and around the esophageal glands, participate at this rapid release. Apparently, the presence of a large number of glands in the abdominal esophagus in dog is a functional necessity developed as an acclimation to this particular situation: food regurgitation is frequent in dogs, and the gland activity increases in animals with gastroesophageal reflux (Van Nieuwenhove & Willems, 1998). The fact that it is not directly linked to the type of alimentation is sustained by the fact that some carnivore species, such as cats, who lack the food regurgitation reflex, present glands solely in the first part of the esophagus (Adlersberg et al., 1955; Barone, 1996).

Conclusions

There are numerous tubuloacinar glands in the abdominal esophagus in dog, arranged in lobules and mainly formed out of mucous acini, but also a small number of mixed acini. In each lobule, there are saciform units with a wide lumen that communicate directly with the excretory channels. This suggests the temporary storage of the secretion product, waiting to be discharged when needed.

The muscle tissue around the glandular lobules suggests the fact that it participates in the evacuation of the temporary deposited secretion products.

All these aspects suggest that the secretion products of these glands are necessary in certain moments. The most plausible role is protecting the esophageal mucosa during the regurgitation process (frequently present in dogs), by neutralizing the pH.

References