Histological studies on the oesophageal tonsils of broiler ducks

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Abstract

Histomorphological study was conducted on the oesophageal tonsils in six broiler Vigova Super-M ducks of six to eight weeks age. The location of the tonsil was at the junction between oesophagus and proventriculus. In histological sections six to eight isolated tonsillar units were seen in the lamina propria near the base of the oesophageal folds. Each tonsillar unit consisted of a crypt lined by lymphoepithelium and surrounded by dense lymphoid tissue. The tonsillar units were seen encapsulated by connective tissue and composed of many large lymphoid nodules separated by internodular areas. The secretory portion of the mucosal glands of the oesophagus were firmly associated with the lymphoid tissue and the cylindrical epithelium was transformed to lymphoepithelium. The oesophageal tonsils offered immunological protection at the entrance of stomach.

Keywords: Oesophageal tonsils, Histomorphology, Ducks

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Introduction

In birds, as in mammals, mucosal surfaces are protected by a specialized branch of local immune system called mucosa-associated lymphoid tissue (MALT). The main component of MALT is gut-associated lymphoid tissue (GALT) seen in digestive system of birds due to the absence of lymph nodes and distinct tonsils in oral cavity (Befus et al., 1980). The oesophageal tonsil is a novel member of the mucosal-associated lymphoid tissue (MALT). It is anatomically located cranial to the stomach, unlike the other parts of the GALT (Nagy et al., 2005). Therefore, it is continuously exposed to undigested environmental antigens, allergens, food and infectious agents. Recently researches involving avian GALT are gaining momentum especially in the development of vaccines to be administered orally.

Materials and methods

For the present study oesophageal tonsils were collected from six broiler Vigova Super-M ducks of six to eight weeks of age. The tonsils collected were cleaned and processed routinely to obtain 5-6µm thick serial paraffin sections. The sections were stained by Haematoxylin and Eosin (Luna, 1968), Gomori's rapid one step trichrome method for collagen fibres (Luna, 1968), Verhoeff's method for elastic fibres (Singh and Sulochana, 1996), Gordon and Sweet's method for reticular fibres (Bancroft and Gamble, 2003) and Mc Manus's method (PAS) for glycogen (Luna, 1968).

Results and discussion

The location of the oesophageal tonsil was cranial to the oesophagus-proventriculus junction. It presented six to eight longitudinal folds and thickening in the oesophageal wall as reported earlier by Olah et al., (2003) (Fig.1). In histological sections in the tonsillar crypts seen in the bottom of the longitudinal folds of oesophagus, lamina propria was heavily infiltrated with lymphoid tissue and formed a tonsillar unit. This was surrounded by a connective tissue capsule (Fig. 2). Here the stratified squamous epithelium (SSE) of oesophagus was converted to lymphoepithelium (LE). In the secretory portion of the oesophageal glands also the epithelium was heavily infiltrated with lymphocytes, macrophages and plasma cells and formed LE. The epithelium lining the excretory duct that opened directly into the lumen of the oesophagus was also infiltrated by migratory lymphoid cells, and transformed to LE (Fig. 3). The oesophageal glands showed strongly positive PAS reaction for glycogen and neutral mucopolysaccharide (Fig.4). The reticular fibres formed an intrinsic meshwork,

in which dense distribution of lymphoid tissue was seen (Fig. 5). The lymphoid tissue comprised of small, medium and large lymphocytes, plasma cells and macrophages. The presence of high endothelial venules (HEV) within these regions was suggestive of a close immunological association of the oesophageal tonsil with other lymphoid organs (Nagy et al., 2005). These are in accordance to the reports of Arai *et al.* (1988). The lymphoid units were seen circumferential in the wall of the esophagus, and did not form a continuous ring. The number of tonsillar units was identical to the number of longitudinal folds, similar to the observations made by Casteleyn et al. (2010). To develop effective oral vaccines, the existence of the oesophageal tonsil has to be taken into account.

Figure1. Digestive tract of duck

1. Folds in oesophagus; 2.Oesophageal tonsil
3. Proventriculus

Figure 2. C.S. of oesophageal tonsil showing lamina propria (H&E X 100)

1. Stratified squamous epithelium
2. Lymphoepithelium
3. Mucous gland with lymphoid accumulation
4. Capsule
5. Crypt

Figure 3. C. S. of oesophageal tonsil showing lympho-epithelium lining the excretory duct (H&E X 100)

1. Stratified squamous epithelium
2. Lymphoepithelium
3. Capsule
4. Excretory duct

Figure 4. C.S. of oesophageal tonsil showing glands (PAS method X 200)

1. Stratified squamous epithelium
2. Lamina propria with lymphocytes
3. Glands

Figure 5. C.S. of oesophageal tonsil showing reticular fibers (Gordon & sweet silver impregnation method X 400)

1. Cortex;
2. Medulla;
3. Reticular fibers

The avian oesophageal tonsil resembled the palatine tonsils of domestic mammals as observed by Yasuda et al. (2002).

Conclusion

A study was conducted on the histomorphology of the oesophageal tonsils in six broiler Vigova Super-M ducks. It was observed that the oesophageal tonsils were avian peculiarities and was well developed and seen at the entrance of the stomach and compensated for the absence of palatine tonsils in pharynx. The unique anatomical location might be of major importance for the induction of immunity after per-oral vaccination in birds.

Authorship contribution statement

Indu V.R.: Conceptualization, Methodology, collection of tissue samples, sectioning, staining, preparation of photomicrograph, Writing - original draft, Writing - review & editing, Project administration.

Biju S.: Conceptualization, Methodology, Writing - original draft, Writing - review & editing, Visualization, Supervision, Funding acquisition

Lucy K.M.: Conceptualization, Methodology, preparation of photomicrograph, Writing - original draft, Writing - review & editing,

Maya S.: Conceptualization, Methodology, preparation of photomicrograph, Writing - original draft, Writing - review & editing.

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Declaration of Competing Interest

All authors declare that there exist no commercial or financial relationships that could, in any way, lead to a potential conflict of interest.

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