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HISTOENZYMIC STUDIES ON THE LYMPHOID TISSUE IN TUBAL TONSIL OF GOATS#

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ABSTRACT

Histoenzymic studies were conducted on the lymphoid tissue in tubal tonsil of six male crossbred goats of six months of age. Tonsillar lymphoid tissue could be located in the lateral wall of nasopharynx, ventral to the auditory tube opening. The surface epithelium of the tubal tonsil was of pseudostratified ciliated columnar type with basal, supporting and goblet cells. Above the dome of lymphoid nodules, the epithelium was modified into a follicle associated epithelium (FAE), also called lympho-epithelium. The surface of tubal tonsil showed folds and invaginations which formed crypts. The lamina propria-submucosa presented dome-like accumulation of primary and secondary lymphoid nodules. The tubal tonsil was not encapsulated. The fibroblastic reticular cell (FRC) in lamina propria were acid-phosphatase (ACP) and alkaline phosphatase (ALP) positive and gave a reticular reaction in the parafollicular and internodular regions and linear reaction in the capsule of lymphatic nodules. The FRC around the lymphatic nodules and internodular regions, the follicular dendritic cells (FDC) in dome, corona and FAE and the B-cell area lymphocytes showed ATPase activity. The intercellular spaces between FAE and the basement membrane, internodular area and mantle zone of the lymphoid nodules showed alphanaphthyl acetate esterase (ANAE) activity in the cytoplasm of T-lymphocytes and macrophages. Both microscopic and histoenzymic studies suggested that the tubal tonsils were histologically mature as a local defence mechanism against the harmful substances to be encountered from the environment.

Keywords: Goats, histology, histochemistry, lymphoid tissue, tubal tonsil

INTRODUCTION

The tonsils or the lymphoid tissue of Waldeyer's ring formed the first line of defence against microorganisms passing through both the digestive and respiratory tracts (Casteleyn *et al*., 2010). The tubal tonsils, a component of Waldeyer's ring, also constituted a part of nasal associated lymphoid tissue (NALT). Specialized cells present in the follicle associated epithelium

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of tonsils were involved in active transfer of airborne and alimentary antigens across the epithelium (Gebert *et al*., 1996). Thus tonsils served as effector organs of local, systemic and mucosal adaptive immunity (Brandtzaeg, 2003).

Although the tubal tonsil has been reported in humans, ruminants, pigs and horse, information on its structure is very few in goats (Casteleyn *et al*., 2011). Hence the present work was undertaken to gain a better understanding of the caprine tubal tonsil.

MATERIALS AND METHODS

Six crossbred male goats aged six months, were procured from University Goat and Sheep Farm, Mannuthy and slaughtered for the present study. The heads were sectioned in median plane and tissue pieces were collected from the nasopharynx around the auditory tube and fixed in 10 percent neutral buffered formalin, Baker's formal calcium solution at 4^0 C, Carnoy's fluid and processed for histological and histoenzymic studies.

The materials were processed by routine histological procedures to obtain 5-6 µm thick serial paraffin sections and were stained by Haematoxylin and Eosin (Luna, 1968) for histological studies. The histoenzymic studies conducted were azo dye coupling method using α naphthyl phosphate for acid and alkaline phosphatases (Bancroft and Stevens, 1996), Lead method for adenosine triphosphatase activity (Bancroft and Gamble, 2003) and acid alpha naphthyl acetate (ANAE) technique for histological identification of T-lymphocytes (Ranki *et al*., 1976).

RESULTS AND DISCUSSION

The tubal tonsil was found mainly ventral to the auditory tube opening on the lateral wall of nasopharynx. The surface of the tonsil showed folds and invaginations which formed crypts. The tubal tonsil was lined by pseudostratified ciliated columnar cells with three types of cells, *viz*. basal, supporting and goblet cells (Fig. 1). Similar observations were made in sheep (Kumar and Kumar, 2012). The surface epithelium was modified into follicle associated epithelium (FAE), over the dome of lymphoid nodules and was characterized by the absence of goblet cells, reduced number of cell layers and absence of cilia and a large number of lymphoid cells due to interrupted basement membrane (Fig. 2). These observations confirmed the reports in tubal tonsils of horse (Kumar and Timoney, 2005).The epithelial cells of FAE helped in intake of antigens, transportation of immunocytes and protection of mucosal surfaces (Brandtzaeg and Halstensen, 1992).

The lamina propria-submucosa underneath the epithelium in goat consisted of dome-like accumulation of primary and secondary lymphoid nodules and diffuse lymphoid tissue arranged as tonsillar follicles or crypto-lymphatic units similar to the reports in horse (Mair *et al*., 1987).The tubal tonsil was not encapsulated. These observations are in accordance with the reports in sheep (Kumar and Singh, 2014).

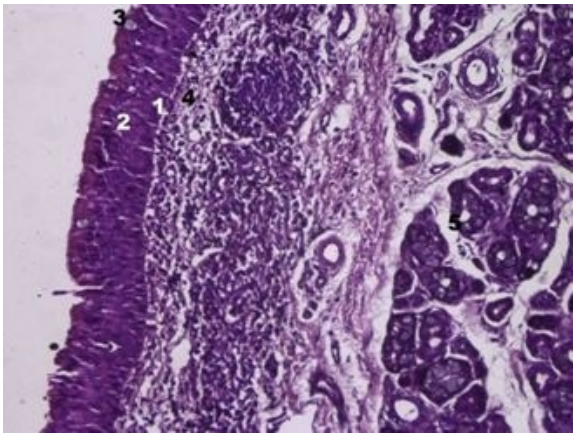

Fig. 1 C.S. of tubal tonsil of goat showing surface epithelium. (H&E x 400)
1. Basal cell
2. Supporting cell
3. Goblet cell
4. Lamina propria-submucosa
5. Glandular acini

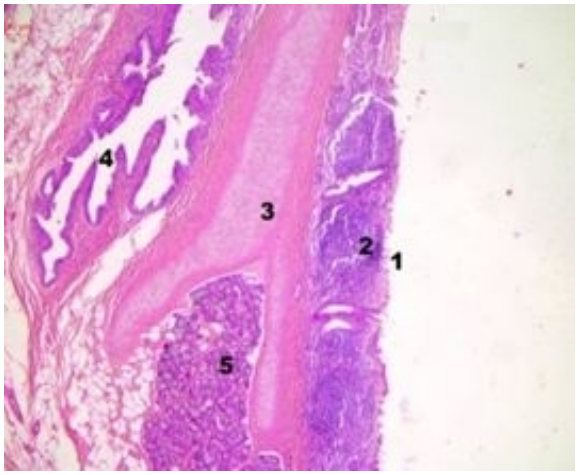

Fig. 2 C.S. of tubal tonsil showing lymphoid tissue ventral to the opening of auditory tube. H&E x 40
1. Follicle-associated epithelium
2. Lymphoid nodule
3. Cartilage
4. Auditory tube opening
5. Glandular acini

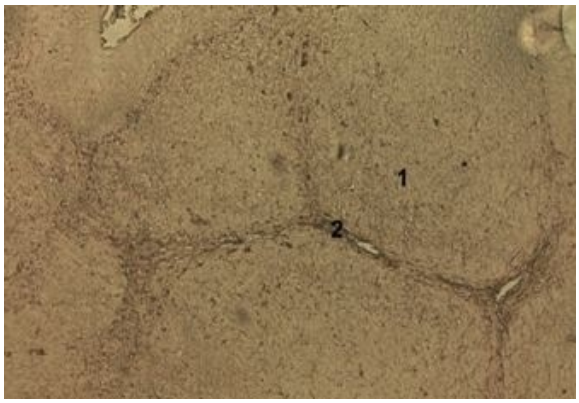

Fig. 3 C.S. of pharyngeal tonsil showing reticular reaction of acid phosphatase. Azo dye coupling method x 100
1. Lymphoid nodules
2. Internodular area

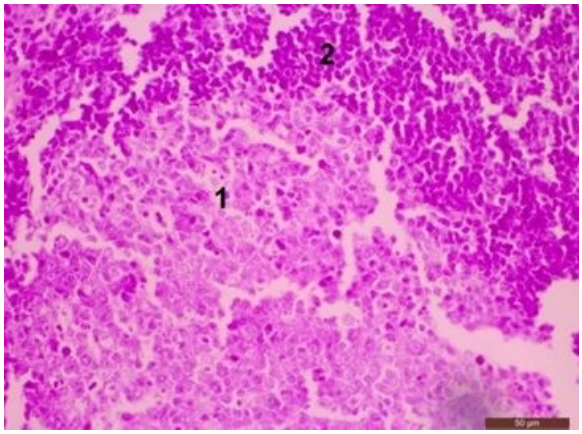

Fig. 4 C.S. of tubal tonsil showing alpha naphthyl acetate esterase activity (arrows). ANAE x200
1. Germinal centre
2. Internodular area

Histoenzymic studies revealed the presence of acid-phosphatase (ACP) positive fibroblastic reticular cell (FRC) in the parafollicular and internodular regions. ACP reaction was not seen in the lymphocytes (Fig. 3).

According to Heusermann *et al*. (1982) the FRCs were mesenchymal cells which formed a special arrangement with reticular fibres for placement of lymphocytes and macrophages.

The FRC also gave a strong alkaline phosphatase (ALP) activity in the centre of lymphatic nodules, internodular area and capsule of lymphatic nodules. The activity was more intense over the corona and domes of lymphoid nodules. This is in agreement with the observations made by Landsverk (1984) in calves.

In tubal tonsils, ATPase activity was seen in the FRC around the lymphatic nodules and internodular regions and the B-cell area lymphocytes. Lymphocytes in T-cell area showed a weak reaction. The follicular dendritic cells (FDC) in dome, corona and FAE also gave reticular reaction suggesting differentiation of FRC to FDC in the secondary lymphoid nodules. No positive reaction could be noticed in the centre of the lymphatic nodules. The ATPase proved to be a marker for FDC, which were developed through transformation of FRC during germinal centre formation and bind antigen-antibody complexes to their surface for long periods and were essential for generation of effective humoral antibody responses (Heusermann *et al*., 1982). According to Ramos *et al*. (1992) differentiation of FRC to FDC were fundamental in the development of secondary follicles. All these observations tally with the reports of Raju *et al*. (2012) in sheep.

Presence of dot-like alpha naphthyl acetate esterase (ANAE) activity was observed in the cytoplasm of T-lymphocytes and macrophages in the intercellular spaces between FAE and the basement membrane, internodular area and mantle zone of the lymphoid nodules. Nearly all lymphocytes in the germinal centres were ANAE negative (Fig.4). These observations tally with the reports of Halleraker *et al*. (1990) in calves.

SUMMARY

The results of the present study revealed that the tubal tonsils in crossbred goats were seen ventral to the auditory tube opening in the lateral wall of nasopharynx. The tonsil was not encapsulated and possessed crypts. The well developed tubal tonsil in goats were histologically mature and served as a means of protection against the harmful substances encountered from the environment.

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