

Histological studies on the vomeronasal organ of sheep (*Ovis aries*)

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ABSTRACT

The histological studies were conducted on the vomeronasal organ of sheep. The lateral wall of the vomeronasal organ was lined with the pseudostratified columnar ciliated epithelium with goblet cells except at the level of first molar tooth where, olfactory epithelium was observed. The PAS-positive goblet cells had acidic and neutral mucopolysaccharides along with sialomucins and hyaluronic acid. Dense irregular connective tissue, seromucous acini, venous caverns and a few nerve bundles constituted the lateral propria submucosa. The medial wall of the organ also had respiratory epithelium up to sixth transverse ruga, caudal to which olfactory epithelium was observed. A stratified squamous non-keratinized epithelium was observed toward lower median portion at the level of third transverse ruga. The propria submucosa of medial wall had reduced blood vessels and glandular acini but an increased number of nerve bundles. The vomeronasal organ was incompletely surrounded by hyaline cartilage.

Key words: Histology, Sheep, Vomeronasal organ

The history of the vomeronasal organ had been studied in sheep (Kratzing 1971), buffalo (Saksena and Chandra 1980), camel (Nagpal *et al.* 1988), goat foetus (Ramakrishna and Tiwari 1988) and goat (Kumar *et al.* 1992). The present study was planned in sheep to elucidate histomorphological features of the vomeronasal organ at different levels of its extent and to compare with other domestic animals.

MATERIALS AND METHODS

The study was conducted on 6 young sheep, 1-1½ years of age, of local mixed breed. The heads were collected from local slaughterhouse immediately after slaughtering and fixed in 10% neutral buffered formalin. The transverse sections of the head were made at the levels of the 3rd, 6th, and 9th transverse ruga of hard palate and anterior to the first premolar and first molar tooth to collect vomeronasal organ. The tissues were processed to make 5-6 µ paraffin sections and stained with Routine Harris' hematoxylin and eosin stain, Gomori's method for reticulum, Weigert's method for elastic fibers, PAS-Alcian blue method for mucosubstances (pH 2.5), Alcian blue method for mucosubstances (pH 2.5), McManus' method for glycogen (PAS), diastase digestion method (Luna

1968) and Crossman's trichrome stain for collagen fibers (Crossman 1937).

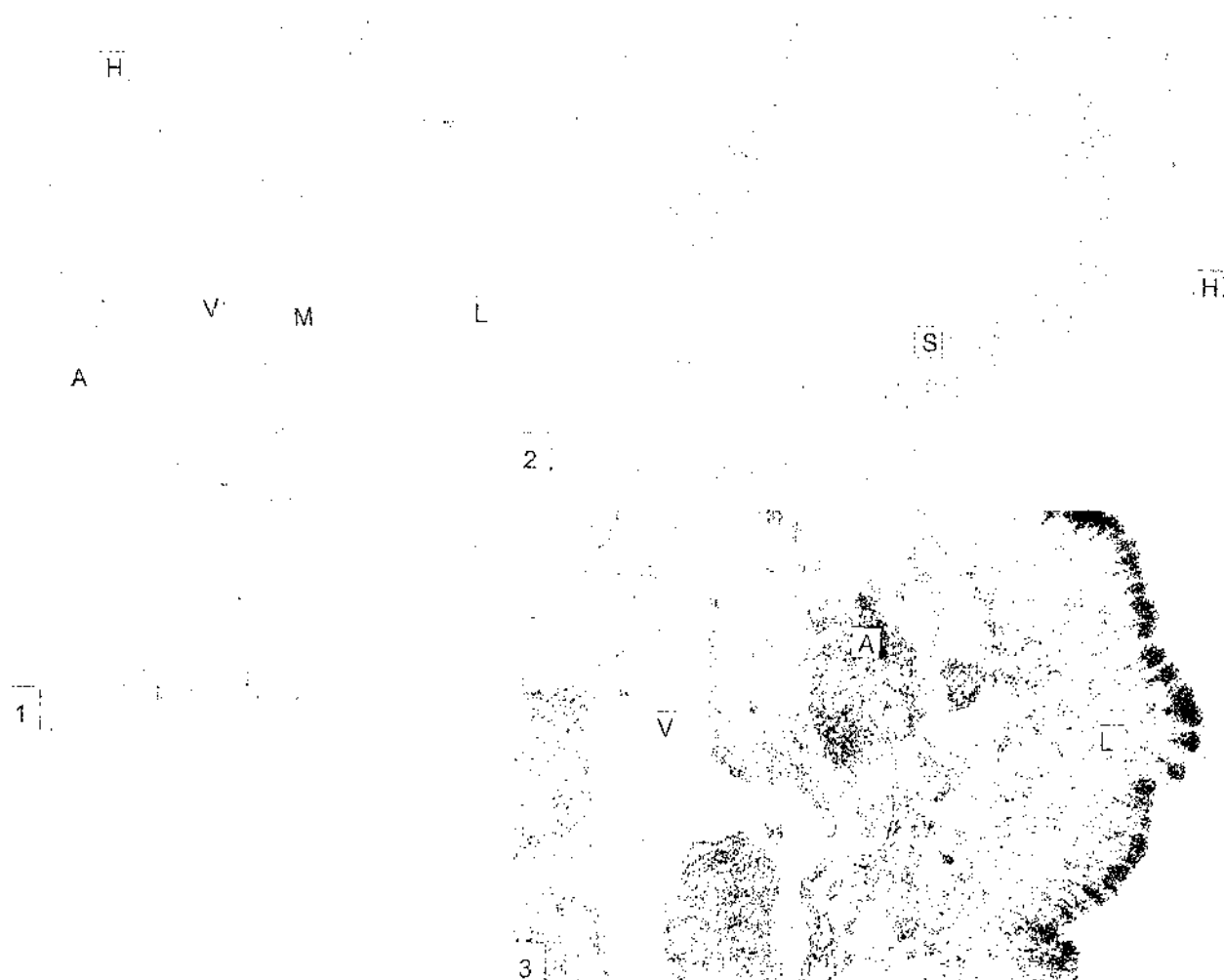
RESULTS AND DISCUSSION

The vomeronasal organ was a paired tubular structure located at ventral aspect of the median nasal septum. It was enclosed in an incomplete inverted 'C' shaped hyaline cartilage, which was lacking towards the dorso-medial aspect. The free dorsal tip of this cartilage showed a thickening whereas the ventral tip was comparatively blunt and narrow (Fig. 1) as reported earlier (Kratzing 1971). A complete comma shaped epithelio-cartilaginous tube had been reported in goat fetuses (Ramakrishna and Tiwari 1988), a complete oval hyaline cartilage at the level of fourth palatine ruga and rostrum of first premolar tooth levels, however, a small portion of the cartilage was deficient dorso-laterally at eighth palatine ruga and mid first premolar tooth levels, (Kumar *et al.* 1992). A complete and 'C' shaped dorsally incomplete hyaline cartilage has been reported in buffalo (Saksena and Chandra 1980, Kumar *et al.* 1981) observed 'C' shaped dorsally incomplete hyaline cartilaginous rings supporting the vomeronasal organ in buffalo. Nagpal *et al.* (1988) reported a 'J' shaped hyaline cartilage surrounding the vomeronasal organ of camel.

The lateral wall of the vomeronasal organ was lined with pseudostratified columnar ciliated epithelium with goblet cells except at the level of first molar tooth where olfactory epithelium was observed (Figs 1, 3, 4, 5). The goblet cells of

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Figs 1-3. 1. Photomicrograph showing respiratory epithelium lining the lateral (L) and medial (M) walls of the vomeronasal organ at the level of third transverse ruga of the hard palate. Note ventral tip of hyaline cartilage (H), and seromucous acini (A) and blood vessels (V) in propria submucosa. H & E stain $\times 20$. 2. Photomicrograph showing stratified squamous nonkeratinized epithelium (S) lining the lower portion of medial and lateral walls of the vomeronasal organ at the level of the third transverse ruga of the hard palate. H & E stain $\times 20$. 3. Photomicrograph showing PAS-positive activity in goblet cells and mucus acini (A) in lateral wall (L) of the vomeronasal organ at sixth transverse ruga of the hard palate. Note presence of large sized venous caverns (V). McManus' method for glycogen $\times 50$.

respiratory epithelium showed strong PAS-positive reaction for glycogen and acidic mucopolysaccharides (Figs 3, 5). A reduced PAS-positive reaction after diastase treatment confirmed the presence of glycogen. A similar type of epithelium was observed in goat at the level of mid first premolar tooth where olfactory epithelium was present in goat (Kumar *et al.* 1992).

The medial wall had respiratory epithelium except at the level of ninth transverse ruga, anterior to the first premolar tooth and first molar tooth where, olfactory epithelium was observed (Figs 1, 3, 5). A stratified squamous non-keratinized epithelium was also observed towards the lower median portion, where lateral and medial walls were continuous with each other (Fig. 2). The medial wall of the organ showed respiratory epithelium at the level of the fourth palatine ruga

and an olfactory epithelium from the level of mid first premolar tooth (Kumar *et al.* 1992).

The respiratory and olfactory epithelia had been reported to line lateral and medial walls, respectively, in bovines (Kratzing 1973), buffalo (Saksena and Chandra 1980, Kumar *et al.* 1981), domestic animals (Dellmann 1993), goat foetuses (Ramakrishna and Tiwari 1988) and camel (Nagpal *et al.* 1988). An olfactory epithelium was observed exactly at the ventral part of the middle region and medioventral side of the posterior region of the vomeronasal organ in buffalo (Saksena and Chandra 1980).

Dense irregular connective tissue, seromucus glandular acini, venous caverns and a few bundles constituted the lateral propria submucosa. The strong PAS-positive mucus acini had mixed distribution of the acidic and neutral



Figs 4-5. 4. Photomicrograph showing respiratory epithelium of lateral wall of vomeronasal organ at ninth transverse ruga of hard palate. Note increased vascularity (V), mucous acini (A) and hyaline cartilage (H) surrounding the organ. H & E stain $\times 20$. 5. Photomicrograph showing strong PAS-positive reaction in goblet cells (C) of lateral wall (L) and mucous acini (A) of vomeronasal organ at ninth transverse ruga of the hard palate. Note olfactory epithelium (O) lining the whole medial wall (M) and upper and lower portions of the lateral wall. McManus' method for glycogen $\times 20$.

mucopolysaccharides (Fig. 5). However, the concentration of sialomucins and hyaluronic acid was mild to moderate. The propria submucosa of medial wall had comparatively lesser number of blood vessels and mucus glandular acini but an increased distribution of the nerve bundles (Fig. 3).

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