Histological Studies on the Omasum of the Sheep (Ovis Aries)

Amit Poonia1, Pawan Kumar2* and Parveen Kumar3
Department of Veterinary Anatomy, College of Veterinary Sciences
Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar-125 004 (Haryana)
Received: 06 October 2012; Accepted: 15 December 2012

ABSTRACT

The present study was conducted on omasum of 10 young sheep of local mixed breed. The omasum presented omasal laminae which were categorized into I, II, III, IV and V on the basis of the length of the laminae and were lined by stratified squamous keratinized epithelium. The lamina propria mucosae was large having loose irregular connective tissue whereas, the lamina muscularis mucosae had longitudinally oriented muscle bundles. These muscle bundles were separated from each other by a comparatively thick inner layer of tunica muscularis in I, II and III laminae. The submucosa was very small having loose irregular connective tissue. Outer longitudinal layer of tunica muscularis was comparatively thinner. Tunica serosa lined by flat cells was comprised of loose irregular connective tissue.

Key words: Laminae, Omasum, Sheep

Sheep rearing is the most popular among economically weaker population of India and it is considered as “mortgage lifter” for the poor farmers. All the functions of omasum are strongly influenced by various histomorphological and histochemical factors such as structure of epithelium, blood circulation in the wall and distribution of enzymes. An attempt has been made earlier to study the anatomy and histology of compound stomach of buffalo (Sengar and Singh, 1970) and goat (Chungath et al., 1985) and (Mahesh, 2008). The present study was planned to explore the histological architecture of the omasum.

MATERIALS AND METHODS

The histological and histochemical study was conducted on ten young sheep (6-9 months age) of either sex of local mixed breed. The stomach along with a small portion of oesophagus and duodenum were procured from the local slaughter house immediately after dressing. Small pieces of tissues were collected from omasal laminae, omasal groove with large papillae and large omasal papillae from each animal. The tissues fixed in 10% neutral buffered formalin solution for 48 hours were processed for routine paraffin technique of light microscopy. The paraffin sections of 5-6µ were stained with routine Harris’ hematoxylin and eosin stain, Gomori’s method for reticular fibres, Weigert’s method for elastic fibres, Mallory’s method for iron, Ayoub-Shklar method for keratin and pre-keratin (Luna, 1968) and Crossman’s trichrome method for collagen fibres (Crossman, 1937). An attempt was made to demonstrate mucopolysaccharides by M cm anus’ method for glycogen (PA S), PA S-Alcian blue method for mucosubstances (pH 2.5), Alcian blue method for mucosubstances (pH 2.5) and diastase digestion method for glycogen (Luna, 1968).

RESULTS AND DISCUSSION

Omasum: The omasum presented omasal laminae which were categorized into I, II, III, IV and V on the basis of the length of the laminae (Fig. 1) as reported in buffalo and calves (Tiwari and Jamdar, 1970; Taluja and Saigal, 1989) and goat (Mahesh, 2008). However, Chungath et al. (1985) in goat reported only three orders of laminae. The first and second order laminae possessed the papillae whereas third order laminae possessed only a few papillae and in fourth and fifth order laminae, the papillae were absent. All the laminae were lined by stratified squamous keratinized epithelium. The stratum basale cells were consisting of round to oval to elongated nuclei (Fig. 2). Their chromatin material was finely basophilic and distributed in the form of fine dusting throughout the nucleoplasm. These cells contained one to two nucleoli. The cytoplasm was finely granular and eosinophilic. The rest of the layers of stratified squamous keratinized
Poonia et al.

epithelium except the stratum corneum were constituted by varying number of rows but generally 5-7 rows of nuclei were observed (Fig. 2). These nuclei were less basophilic than the stratum basale cells. A few lightly stained very large sized and a few dark stained small sized nuclei were also observed. The density of the nuclei was very less towards the stratum corneum. The stratum corneum was constituted by 3-4 rows of cells having darkly stained elongated nuclei showing degenerative changes. The cytoplasm of these cells was more eosinophilic than the adjacent cells. The presence of vacuolated areas in between the epithelial cells was a regular feature. Ayoub Shklar method demonstrated the presence of keratin.

The lamina propria mucosae was large having loose irregular connective tissue having collagen, reticular and elastic fibres, few fine blood capillaries and connective tissue cells. The concentration of connective tissue varied at different places and also in the different types of laminae. The lamina muscularis mucosae showed presence of muscle bundles which were longitudinally oriented parallel to the length of omasal laminae. These muscle bundles of outer and inner surfaces were separated from each other by a comparatively thick inner layer of tunica muscularis in type-I laminae. However, the muscle layers were almost of equal thickness in type-II laminae onwards. Towards the free apical portion of these laminae, the muscle of both the layers intermixed with each other and was difficult to discern from each other. The submucosa was very small having loose irregular connective tissue being constituted by a mixed distribution of collagen, reticular and elastic fibres. Inner circular layer of tunica muscularis was very much thicker and penetrated in the core of I, II and III laminae in between the two layers of lamina muscularis mucosae as reported earlier (Tiwari and Jamdar (1970; Taluja and Saigal, 1989; Mahesh, 2008). Outer longitudinal layer was comparatively thinner. The tunica serosa was constituted by a layer of flat mesothelial cells being supported by loose irregular connective tissue having fine blood capillaries, small sized blood vessels, few nerve fibres and fatty tissue.

The epithelial surface of type-I and II laminae presented small sized papillae which were broader and blunt in the later laminae. The epithelium height and number of rows of cells varied at different places. The concentration of connective tissue was increased in the region of papillae.

Omasal groove with large papillae: Omasal groove presented large sized primary papillae and small sized secondary papillae (Figs. 3, 4). These primary papillae having irregular undulating outer surface were lined by stratified squamous keratinized epithelium. The cells of stratum basale were having round to oval nuclei with one to two centric or eccentric nucleoli. The cytoplasm was finely granular and eosinophilic. A few cells having large nuclei penetrated in between these cells from underlying lamina propria mucosae.

The basal surface of epithelium was uneven due to the formation of papillary pegs. The rest of the layers of stratified squamous epithelium presented a few very large sized, densely basophilic nuclei which were oval to elongated with their longitudinal axis vertically oriented towards stratum basale. The cells towards the superficial layer were having basophilic nuclei of smaller dimensions and these were oriented in different planes. The more superficially placed nuclei close to the stratum corneum showed degenerative changes. The cytoplasm of all these cells was finely granular and eosinophilic. The 2-3 layers of stratum corneum were having darkly stained elongated nuclei with degenerative changes. The keratinized layer was disrupted at irregular intervals.

The lamina propria mucosae was having loose irregular connective tissue, fine blood capillaries, collagen, reticular and elastic fibres. The lamina muscularis mucosae was present in the form of few isolated small sized smooth muscle bundles on either side of these papillae. Large bundles of inner circular layer of tunica muscularis were sandwiched in between the lamina muscularis mucosae placed on either side. The tunica submucosa was having very small amount of irregular loose connective tissue. The tunica muscularis was having thicker inner circular and thinner outer longitudinal layers of smooth muscles. At the junction of these two muscle layers the connective
At the base of the primary papillae, the fold of mucosa of omasal groove led into generally two small sized secondary papillae which were of almost equal height and were lined by stratified squamous keratinized epithelium. The cells of the stratum basale had histological features similar to the primary one. The basal surface was undulating because of the formation of papillary projections. The rest of the layers were variable in thickness and at places only 2-3 cell layers were observed. The lamina propria mucosae led into the submucosa because of the absence of lamina muscularis mucosae. The tunica muscularis and tunica serosa were having similar histological features as described earlier.

**Large papillae:** The large omasal papillae present towards the abomasum were categorized mainly into 2 types, i.e. large with rounded and broader free tips and comparatively smaller conical papillae (Fig. 4). The characteristic features of broader papillae was that small sized secondary papillae were present on either side at the base of these papillae. These papillae had features of epithelium like that of the broader primary papillae. The histological features of these different layers of epithelium were almost identical to omasal groove except that at few places the epithelium was constituted by only few cell layers.

The lamina muscularis mucosae in the form of a few isolated thin bundles of smooth muscles was present on either sides of these papillae and did not reach up to the apical surface (Fig. 4). Between these muscle bundles of lamina muscularis mucosae, a very thick layer of inner circular layer of tunica muscularis was present which reached up to the free apical surface. The inner circular muscle layer penetrated these broader papillae and
constituted the majority of the core of papillae. Small to large muscle bundles were present in between the two layers of tunica muscularis.

At the base of these papillae, a few very small sized bundles of lamina muscularis mucosae were observed which were separated from the inner circular layer of tunica muscularis by a thin submucosa as reported by Tiwari and Jamdar (1970) in buffalo calves, Taluja and Saigal (1989) in buffalo and Chungath et al., (1985) in goats.

The second type of conical papillae having broader base and narrow tips. The cellular characteristic and histological features were almost similar to broader papillae. The connective tissue was more towards the apical portion as the lamina muscularis mucosae and inner circular layer of tunica muscularis did not reach up to the apical surface of these papillae.

Omaso-abomasal junction: It was characterized by an abrupt change from stratified squamous keratinized epithelium into simple columnar epithelium lining the abomasum. The mucosa of the omasum was folded to form small papillae towards the free surface. The epithelium was thicker than that of adjacent abomasum and all the strata were distinct. The nuclei were lightly stained and few vacuolated areas were interspersed in between these cells. The stratum corneum was thin. The lamina propria mucosae was having loose irregular connective tissue. The lamina muscularis mucosae was absent. The tunica submucosa was having loose irregular connective tissue. The tunica muscularis showed presence of single layer of circular muscles which were separated from each other by large amount of connective tissue and collagen fibres. At the base of these, large amount of fatty tissue, connective tissue, fine blood capillaries were present which merged with the connective tissue of abomasum.

REFERENCES


