

Scanning Electron Microscopic Observations on the Horse Parotid Glands

Syusaku SUZUKI, Hayao NISHINAKAGAWA and Junichi OTSUKA

(Laboratory of veterinary Anatomy)

Received for Publication September 2, 1980

Introduction

A few reports have been made public on the morphological study of horse parotid glands after Ellenberger's review¹⁾. In the recent years, some reports^{3,4)} have been published on this subject histologically as well as from the transmission electron microscopical point of view, and the structures of acinus, intercalated duct and striated duct of the horse parotid gland were studied with the light- and transmission electron-microscopies by our group⁵⁾. On the other hand, the scanning electron microscopic study of the salivary gland has been reported in rats²⁾, dogs⁶⁾, goats⁷⁾ and cattle⁸⁾. However, to our knowledge, the scanning electron microscopic observations of fracture surfaces and luminal surfaces of the ducts of horse parotid glands have not been attempted, yet.

The present study observed the fracture surface of horse parotid gland with the scanning electron microscope and made a comparative examination with the transmission electron micrographs.

Materials and Methods

The parotid glands were removed, under fluothane (2-bromo-2-chloro-1, 1, 1-trifluoroethane) anesthesia, from six adult Thoroughbred horses (four females and two males). The tissues were removed immediately from the central part of the parotid gland. Details concerning the preparation of tissues and observational methods were reported in our previous works^{6,7)}.

Results

In the fracture surface of the horse parotid gland, the gland was found divided into lobulus by large amount of loose connective tissue. In the structures of lobule, acini and striated ducts were easily perceived (Fig. 1), while it was difficult to find the intercalated duct as well as light- and transmission electron-micrographs.

Acinus: Each acinus of the horse parotid glands was surrounded by varying amount of loose connective tissues, showing polygonal outline. The lumina of acini and intercellular canaliculi were narrow and usually difficult to be found out. The luminal surfaces of acini were narrow and did not having any structural features excepting quite a few numbers of short microvilli. The acinar cells contained numerous and variously sized spherical secretory granules, fractured granules and concaves (Figs. 2, 3). The fractured granules showed homogeneous surfaces and it was not possible for us to find two-phase structures (Fig. 3). The cell possessing the oblong nucleus which was considered myoepithelial cell and blood capillaries were seen around the acini (Fig. 2). In transmission electron micrograph, the acinar cells contained various secretory granules with limiting

membrane: Round or amorphous granules of low and moderate densities, round granules containing a homogeneous corpuscle of high density (Fig. 4).

Intercalated duct: Intercalated ducts were difficult to be found-out because it was short in length. The short microvilli were scattered sparsely on the luminal surfaces. Secretory granules could not be found in the cytoplasm and there was no morphological evidence of secretion from the intercalated duct as in case of the transmission electron micrograph.

Striate duct: The epithelial cells of the striated duct of parotid gland in the horse were tall and columnar in shape and were in possession of central nuclei. The epithelial cells had the typical basal infolding as well as the prominent accumulation of mitochondria lying between basal infolding. The luminal surfaces of the striated duct cells were usually pentagonal in outline, and the apical surfaces of the epithelial cell of the striated ducts were characterized in three forms (Fig. 5), the first one was of flat structures, the second one was of small concaves and of reticular structures possessing a number of relatively short microvilli (Fig. 6), and the last one was of the spheroidal protrusions. In the structural types of the spheroidal protrusions, relatively smooth structures (Fig. 7), irregular folds, crater-like concaves, small pores (Fig. 8) and short microvilli (Fig. 9) were noted respectively. Most striated ducts were found to be in possession of the former two structures, while some were noted to be supplied with three structures mixed up. Unlike both in case of acinar cells and in that of epithelial cells in the intercalated ducts, no epithelial cells could be observed containing spherical granules.

Discussion

The component cells of the acini in the horse parotid gland were exclusively made of serous cells as we have reported previously⁵⁾. In the transmission electron micrograph, the acinar cells were composed of light, dark and specific light cells containing round or amorphous granules of low and moderate densities and round granules supplied with a homogeneous corpuscle of high density. In the present scanning electron micrograph, acinar cells contained smooth spherical granules. The spherical granules of this type were observed in the parotid acinar cells in rats²⁾, dogs⁶⁾ and goats⁷⁾ and in the seromucous cells of the bovine mandibular glands⁹⁾. As described previously in the report of the dog parotid gland⁶⁾, it was supposed that the serous granules containing much enzyme protein turned into the spherical granules of high density in the occasion when they were fixed by osmium tetroxide and aldehyde as conventionally done. Probably this spherical granules may be identical with the dense round granules shown by the transmission electron micrograph.

In the present study, no morphological evidence of the existence of secretory granules could be observed in the intercalated duct cells of horse parotid glands as in case of the transmission electron images⁵⁾.

The apical surfaces in various forms of the epithelial cells of striated ducts may perhaps be due to the secretory function of the cells as reported previously in dogs⁶⁾, goats⁷⁾ and cattle⁸⁾. However, the striated duct cells showed no morphological evidence of the existence of secretory granules in both of the transmission and scanning electron microscopies. Therefore, as well as in the dog⁶⁾, goat⁷⁾ and bovine⁸⁾ parotid striated ducts, the striated duct cells of the horse parotid gland also secrete mainly large quantities of electrolytes and water, and in this case the prominent basal infolding and numerous mitochondria seem to be closely connected in the function of transferring of water.

From this investigation, it was found that the fracture surfaces of the horse parotid glands are basically similar to the structures of the dog parotid gland unlike in the cases of cattle and goat.

Summary

Three-dimensional architecture of the horse parotid gland obtained by the freeze cracking in DMSO was observed with the scanning electron microscope.

The lumina of acini were narrow and usually inconspicuous, and the luminal surfaces of acinar cells showed quite a few numbers of short microvilli. Acinar cells contained numerous spherical secretory granules which were of smooth surface and full of variety in their sizes.

Intercalated ducts were lined with simple cuboidal epithelial cells, and no morphological evidence of secretory granules could be seen.

The luminal surfaces of the striated duct cells were pentagonal in outline, and the apical surfaces of the epithelial cells were characterized by three features: The first was that of the flat structures, the second was that of coarse structures possessing a number of short microvilli, the third was that of ovoidal or spheroidal protrusions of various sizes. No spherical granules could be seen contained in the epithelial cells of striated ducts as observed in the acinar cells.

References

- 1) Ellenberger, W.: *Handbuch der Vergleichenden Mikroskopischen Anatomie der Haustiere*, Berlin. (1911) (cited by 3)
- 2) Kozaka, H.: Scanning electron microscopic observations of the rat salivary glands (in Japanese). *Acta Anat. Nippon.*, **51**, 123–124 (1976)
- 3) Makita, T., Kiwaki, S. and Shibanaï, D.: The histological study of the salivary glands of the domestic animals. 1. The fine structure of the acinar cells of the horse parotid gland. *Bull. Fac. Agr. Yamaguti Univ.*, **18**, 983–1014 (1967)
- 4) Shibanaï, D. and Shindo, J.: Anatomico-pathological and histo-pathological studies on the parotid and submaxillary glands of the horse (1) (in Japanese). *Bull. Nippon Vet. Zootech. Coll.*, **1**, 63–76 (1952)
- 5) Suzuki, S. and Otsuka, J.: On the fine structure of salivary gland of horse 1. parotid gland (in Japanese). *Bull. Fac. Agr. Kagoshima Univ.*, **27**, 95–104 (1977)
- 6) Suzuki, S., Nishinakagawa, H. and Otsuka, J.: Scanning electron microscopic observations of the dog parotid glands (in Japanese). *Bull. Fac. Agr. Kagoshima Univ.*, **30**, 87–96 (1980)
- 7) Suzuki, S., Nishinakagawa, H. and Otsuka, J.: Scanning electron microscopic observations on the goat parotid glands. *Jpn. J. Vet. Sci.* in press
- 8) Suzuki, S., Nishinakagawa, H., Otsuka, J. and Mochizuki, K.: Fine structure of the bovine parotid gland. *Jpn. J. Vet. Sci.* in press
- 9) Suzuki, S., Nishinakagawa, H. and Otsuka, J.: Fine structure of the bovine mandibular gland. *Mem. Fac. Agr. Kagoshima Univ.*, **17**, 147–155 (1981)

Explanation of figures

- Fig. 1. Acini and striated duct surrounded by varying amounts of loose connective tissue in the horse parotid gland. Lumina of acini and intercellular canaliculi are inconspicuous. Some residual secretory materials are observable in the striated duct.
- Fig. 2. Acinar cells of the horse parotid gland. The luminal surface of acinar cells exhibits quite a few short microvilli. Numerous smooth spherical granules and fractured granules are observable. The cells possessing the oblong nucleus which is considered myoepithelial cell and blood capillaries, are seen around the acinus.
- Fig. 3. Acinar cell of the horse parotid gland. Smooth spherical granules, fractured granules, concaves and fractured nucleus are observable in cytoplasm.
- Fig. 4. Transmission electron micrograph of acinar cells in the horse parotid gland. Various secretory granules with limiting membrane are present in the apical portion.
- Fig. 5. Luminal surface of the striated duct in the horse parotid gland. The flat or coarse structures possessing a number of short microvilli and the variously sized spheroidal protrusions are observable.
- Fig. 6. Luminal surface of the striated duct in the horse parotid gland. Small concaves and reticulate structures possessing short microvilli are observable.
- Fig. 7. Luminal surface of the striated duct in the horse parotid gland. The protrusion and short microvilli are observable. The protruding apical surface is relatively smooth.
- Fig. 8. Luminal surface of the striated duct in the horse parotid gland. Protrusions show irregular folds, small pores and crater-like concaves.
- Fig. 9. Luminal surface of the striated duct in the horse parotid gland. Short microvilli are observable in the protruding apical surfaces.





