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Intercellular Secretory Canaliculi in the Feline Laryngeal Gland

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Summary. Laryngeal glands of adult cats were observed by scanning electron microscopy. Intercellular secretory canaliculi in the gland were an arborized system of capillaries extended among acinar cells, and their stem or collecting canaliculus opened to the gland lumen. The inner surface of the canaliculi was provided with small globular microvilli. The canaliculi in the laryngeal gland resembled the hepatic bile capillaries in lower vertebrates.

Compound types of glands, such as salivary glands, the pancreas, sweat glands, have secretory canaliculi which are cleft-like spaces in the mass of parenchymal cells and which conduct secretion into the acinar lumen. Light microscopy of these glands indicated that the secretory canaliculi consisted of a branched capillary system in between the adjoining secretory cells (cf. histological textbooks of BARGMANN, 1964; GOERTTLER, 1969; TOGARI and ITO, 1971; GREP and WEISS, 1973; BUCHER, 1973; FAWCETT and BLOOM, 1975; etc.). Electron microscope observation revealed the development of microvilli on the capillary wall and the junctional complex between adjoining cells (TANDLER, 1962; TAMARIN and SREEBNY, 1965; ITO and SHIBASAKI, 1966; KUROSUMI and KUROSUMI, 1970).

In the course of our scanning electron microscope study of laryngeal epithelium, intercellular canaliculi were observed in the laryngeal gland of the cat. The present paper deals with a description of the three-dimensional extension of the canaliculi in the gland, with special reference to their resemblance to the bile capillaries of the liver.

Materials and Methods

Larynges were removed from anesthetized adult cats and immersed in a 2.5% glutaraldehyde solution adjusted to pH 7.4 with 0.1 M phosphate buffer under room temperature. The fixed larynges were dehydrated with a series of graded alcohol and transferred into iso-amylacetate. The larynges were then frozen in liquid nitrogen and cracked into small pieces (FUJITA, 1974; TOKUNAGA et al., 1974). The tissue pieces were dried by the critical point method using liquid carbon dioxide (TANAKA, 1972). The dried specimens were then coated with gold in an ion-coater and observed under a scanning electron microscope (Hitachi SSM-2 type). The accelerating voltage used was 10kV.

Observations and Discussion

Under the scanning electron microscope, the cut surfaces of the laryngeal wall showed three layers. There were a compact layer of columnar epithelium, a spongy

Fig. 1. A scanning electron micrograph of a cut surface of the laryngeal wall. Glands (G) are massive structures in a connective tissue layer containing blood vessels (V). C cartilage, Ep epithelium. $\times 600$

Fig. 2. Legend in opposit page.

layer of connective tissue, and a massive layer of cartilage (Fig. 1). In the connective tissue layer, cell masses and walled holes of various sizes were seen which were capsulated by fibrous components. The cell masses corresponded to the glands cut open and the holes to the vessels cut open. The glandular epithelium, like a wall, surrounded a groove of the glandular lumen. The thickness and cellular stratification of the wall varied by glands or regions inside of one gland. Some represented a simple layer of columnar cells of a uniform thickness of about 15μ , while others were a stratified layer of pyramidal cells (Fig. 2, 3, 4). The luminal space most often showed a concave end. The occurrence of two types of the glandular epithelia and the form of glandular lumen indicated that the laryngeal gland in the cat was a tubuloacinar gland. In the wall of the acinar gland, pyramidal cells resting on the basement membrane were not in direct contact with the acinar lumen.

The luminal surface of the gland was a pavement of quadrate or hexagonal free surfaces of epithelial cells. On the luminal surface were seen many holes of 1 or 3μ in diameter. The holes were funnel-like in shape and were numerous on the acinar

Fig. 3. A scanning electron micrograph of a tubuloacinar portion of the laryngeal gland. Acinar portions (*A*) of the gland are seen as hemispherical protrusions on the tubular portion (*T*) with an evenly thickened wall. Some round holes are seen on the luminal surface of the acinar portions. At the right upper corner is shown the intercalated duct (*ID*) of a gland which is longitudinally cut open. *It* interstitial connective tissue $\times 600$

Fig. 2. The luminal surface of a terminal portion of the gland showing a pavement pattern of polygonal cell surfaces. Round holes on the luminal surface are openings (*O*) of intercellular canaliculi. Canaliculi sectioned longitudinally (arrows) are seen in a gland wall. *B* basement membrane. $\times 1,700$

Fig. 4. A closer view of the box in Figure 3. Intercellular canaliculi hit longitudinally (arrows) are a thin furrow between neighboring cells. They are confluent into a large canaliculus which opens onto the glandular lumen (*L*). A large arrow indicates another cut profile of the intercellular canaliculus. *B* basement membrane, *N* nucleus, *O* opening of a canaliculus. $\times 3,000$

Fig. 5. Legend in opposit page.

wall lining the concave space mentioned above.

Intercellular canaliculi cut open were visible as thin furrows (Fig. 2-6) or holes (Fig. 5, 6) in the glandular wall. Their free surface was characterized by numerous, small globular microvilli of about 50 nm in diameter (Fig. 4, 5). A large canaliculus of 3μ or more was often found near the acinar lumen (BRAUS, 1924). It originated at the hole on the luminal surface and, extending deeper, branched into smaller canaliculi to form a tree-like system (canalicular tree) (Fig. 3-5). Therefore, the luminal stem-portion of the system might be called a collecting or intercalated canaliculus. The occurrence of the canalicular tree was usually seen in hemispherical bulges of the acinar wall (Fig. 3, 4).

Transverse cross sections of the canaliculi showed that a canalicular lumen was often located in the center of three or more adjoining cells (Fig. 5, 6). Sometimes, the lumen has been shown to be between two cells such as in the human sweat gland (HIBBS, 1958; MUNGER, 1961; ITO and SHIBASAKI, 1966). The extensions of the canaliculi were mostly observed on the lateral crests of the glandular cells. The intercellular canaliculi extending toward the base of the acinar cell were usually terminated a short distance above the basement membrane (Fig. 2, 4). The findings of the present study indicate that the intercellular canaliculus of the laryngeal gland is essentially similar to the bile capillary, especially of lower vertebrates (BARGMANN,

Fig. 6. A horizontal cut surface of the glandular epithelium. Intercellular canaliculi, which are cut longitudinally (double arrow) and transversally (single arrow), are located between neighboring cells. *L* luminal surface of glandular cells, *N* nucleus, *O* opening of a canaliculus. $\times 2,700$

Fig. 5. A cut surface of the acinar portion of the gland. Branched canaliculus between acinar cells is open on the acinar lumen (*L*). Arrows indicate cross sections of canaliculi. Aggregations of secretory granules are seen around the canaliculi. *N* nucleus. $\times 3,000$

1964; OGAWA and MIYOSHI, 1975).

In addition, spherical secretory granules of 0.5μ in diameter were aggregated in the cytoplasm just beneath the canalicular surface. A figure indicating the process of secretion release was not obtained in this study, but the situation of the granules suggested that they were being released into the canaliculi.

ネコ喉頭腺の細胞間分泌細管

財 津 昭 憲

ネコ成体の喉頭腺を走査電子顕微鏡で観察した。喉頭腺の細胞間細管は腺細胞のあいだを樹枝状にのびて毛細管樹を形成していた。その毛細管樹の幹にあたる集合細管は腺腔に開口していた。細管の内面は小球状の微絨毛でおおわれていた。喉頭腺でみられる細胞間分泌細管は、下等脊椎動物の肝臓でみられる毛細胆管に似ている。

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