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HISTOLOGICAL OBSERVATIONS ON THE EPIPHYSIS CEREBRI AND ON THE CHORIOID PLEXUS OF THE THIRD VENTRICLE OF THE DOG

W. G. VENZKE AND J. W. GILMORE

The epiphysis cerebri has long been a subject of considerable interest and until only very recent time has its histological components been elucidated in several species. The physiological role of the epiphysis in the body has not yet been worked out. From time to time the histological as well as the physiological conceptions regarding this organ have changed.

Galeno (8) first regarded this organ as a gland. Later Descartes (6) regarded the epiphysis as the seat of the soul. These suggestions have been followed by others which consider the epiphysis as an organ with a purely mechanical role concerned with the circulation of the cerebrospinal fluid and as a rudimentary, degenerated, or atrophying organ without function.

The histological interpretation of the epiphysis of several species of animals has passed through rather diverse stages. Until recently, data in regard to the fundamental constitution of its parenchyma in the human, monkey, cow, sheep, rat, and rabbit were not precise.

It is the purpose of this manuscript to present the authors' histological interpretation of the components of the epiphysis cerebri and of the chorioid plexus of the third ventricle of the dog. The literature pertaining to the histological components of these structures is very meager. It would seem logical that before the physiological role of these structures in the body can be thoroughly established it would first be necessary to elucidate the histological picture.

Perhaps the most interesting stages in the cytological knowledge of the human epiphysis are marked by the investigations of Bizzozero (2) on the nuclear types, the work of Weigert (5) on the neuroglial framework, the investigation of Cajal (3) on the nervous framework, Dimitrova (7) on the phenomena of excretion by the nuclei, and the interesting work of Achurcarro and Sacristan (1)

on the cells of a sympathetic type with prolongations ending in clubs.

All of these investigators have distinguished two or three types of cells in the parenchyma. Bizzozero (2) distinguished two cell types in the human epiphyseal lobules. He regarded these as nervous and connective. The former are characterized by the presence of a small amount of protoplasm, either elongated or roundish, with processes interwoven in a very fine plexus and large oval nuclei. The connective cell type has elongated, dense protoplasm, with very thin processes, pigment granules and dark nuclei. These investigators have also assigned either lymphatic, nervous, neuroglial or glandular characteristics to the epiphysis.

MATERIAL AND METHODS

The epiphyseal region of the brain has been investigated in dogs of various ages. All material was removed immediately following death and fixed in either formalin, Zenker-formol, Susa, Bouin, or Ranson's fixative. Sections were cut for the most part in the sagittal, but also in the coronal plane. The trimming of the brain necessary was performed after the fixation was complete.

Various stains were employed to bring out the components of the epiphyseal parenchyma and chorioid plexus. The following stains were used with success: haematoxylin and eosin, Koneff's, Ranson's, and a modified Weigert-Pal process.

GROSS ANATOMY OF THE EPIPHYSIS

The epiphysis or pineal body consists of the pineal gland and the pineal peduncle. In the pineal peduncle there is a recess, the pineal recess. The pineal body is for the most part double cone-shaped. It is covered by the splenium of the corpus callosum and by the great cerebral vein. It lies between the anterior corpora quadrigemina, and is just above the aqueduct of Sylvius. Removal of the epiphysis necessitates opening the third ventricle of the brain, the posterior wall of which it forms a part. Cutore (5) gives the pineal index of the dog as 0.005 based upon the relative weight of the pineal body to the brain weight in grams. We have confirmed this observation.

HISTOLOGICAL STRUCTURE

The epiphysis is surrounded by a thin connective tissue capsule. The trabeculae which penetrate the parenchyma from the capsule are not very distinct. Rather dense connective tissue appears to

form a large part of the framework of the gland. The dog epiphysis is not distinctly lobulated like the human epiphysis.

In sections stained with the nuclear techniques the epiphysis appears to be formed by irregularly scattered nuclei apparently surrounded by a reticulated protoplasmic mass with syncytial aspect. The cell nuclei vary in shape but are usually round. Their diverse degrees of staining suggests at first that the parenchyma consists of several cell types. When carefully analyzed, however, there are only two types with distinct characteristics.

In the dog epiphysis only two nuclear types are clearly perceived; namely, pale nuclei with rather conspicuous nucleoli and small chromatin granules, and dark nuclei with homogeneous or granular character. The chromatin granules are larger and more scattered than in the above nuclear type. Both types of nuclei vary in shape and volume, but the dark nuclei are usually smaller. The pale nuclei predominate in numbers.

Near the periphery of the gland, small concentric masses of connective tissue are present. Within some of these masses of connective tissue small darkly staining cell nuclei are found. Also, near the periphery of the gland many blood vessels are seen. Following the use of nerve staining techniques small nerve fibers are seen penetrating the parenchyma. Occasionally pigmentation is seen in the protoplasm of some of the cells, but never have calcareous concretions been observed.

THE CHORIOID PLEXUS OF THE THIRD VENTRICLE

The roof of the third ventricle of the brain is formed by a single layer of epithelium, which stretches between the upper edges of the lateral walls of the cavity and is then continuous with the epithelial lining of the ventricles. This epithelium is covered by and attached to a fold of pia mater. Both together form the tela chorioidea. From the under surface of the tela chorioidea a pair of vascular fringed processes, the chorioid plexuses of the third ventricle, project downwards, one on either side of the median plane, and invaginate the epithelial roof into the ventricular cavity. The pial portion of the tela chorioidea is triangular in shape and lies beneath the fornix. The lateral portions of its lower surface rest upon the thalami, and medial portion of this surface is in contact with the epithelial roof of the third ventricle. Its apex is situated at the interventricular foramen. The base occupies the interval between the splenium of the corpus callosum above and the corpora quadrigemina and epiphysis below.

HISTOLOGICAL STRUCTURE

The chorioid plexus is composed of a highly vascular pial membrane. In this tissue the collagenous fibers form a loose network which is condensed just under the epithelium and also at the bases of the villi. Most of the subepithelial portion of the plexus is formed of blood vessels. These vessels present a large venous sinus and dilated capillaries which lie within each villus.

The epithelial cells of the plexus vary from a round to flat cuboidal shape. All of the cells are rounded on their surface facing the lumen. The cells have a large round nucleus with usually one or two nucleoli.

In the epithelial cells of the plexus the protoplasm must be emphasized. The protoplasm is exceedingly granular. This granular appearance is most noticeable near the periphery of the cells. A clear area is usually found surrounding the nuclei. Occasionally at the surface of the cells, secretion products are seen, and in such cases the cytoplasm of the cells has a vacuolous appearance.

The results of a number of investigators Pettit and Girard, (13), Galeotti (9), Studnicka (15), and Prenant and Bouin (14), ascribe to these epithelial cells a secretory function. The above mentioned morphological facts speak for such a function.

Kalwaryiski (11, 12), has shown that the epithelial cells of the plexus of the dog have a thin delicately striated cuticular border. We have not been able to demonstrate this striated cuticular border. We are of the opinion that the secretion products seen on the surface of the cells may be confused with a cuticular border.

The nerves of the chorioid plexus are described by a number of investigators and in recent papers by Junet (10) and Clark (4).

DISCUSSION AND CONCLUSIONS

The epiphysis presents a thin connective tissue capsule surrounding the parenchyma which gives no evidence of lobulation. The parenchyma consists of cells which possess large nuclei and those which possess small nuclei. Both types of cells show very scanty amounts of cytoplasm, but send out few pointed processes which end a short distance from the cell body without ending in club-shaped enlargements as is true of the human epiphysis. Nerve trunks and fibers are found in the parenchyma. Pigmentation is occasionally seen in some of the cells, but no calcareous concretions occur. There are few blood vessels in the gland.

The chorioid plexus is composed of a highly vascular pial mem-

brane. The epithelial cells of the plexus vary in shape and present evidence of being a secretory type of cell.

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