A GLIOMA IN A DOG AND A PINEALOMA IN A SILVER FOX
(VULPES FULVUS) ¹

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Only a small number of primary intracranial neoplasms have been observed in mammals and birds. Either they do not occur as frequently in lower animals as they do in man or they are overlooked. The latter is a probable explanation, as only a small number of animals that die of natural causes come to necropsy and because of the difficulty of opening the cranium with inadequate equipment this part of the examination generally is omitted.

Slye, Holmes and Wells, in 1931, reviewed the literature on intracranial and cord tumors of lower animals and found only 36 cases reported. Twenty-six of these were intracranial tumors, 11 of which were in the hypophysis. They at that time reported 4 new cases of primary intracranial neoplasms, 3 occurring in mice of the Slye stock and one in a green parrakeet (Agatornis pullaria). The neoplasms found in the mice were: an endothelioma of a cerebral peduncle, a papillomatous growth in the ependyma of the lateral ventricle, and an infiltrating adenoma of the hypophysis. The tumor observed in the parrakeet was an adenoma in the hypophysis. In their summary these writers mention that it is especially noteworthy that only one seemingly conclusive report of a cerebral glioma in an animal could be found. Dawes, in 1930, reported two intracranial neoplasms in dogs. One was an ependymal glioma in the right lateral lobe of the cerebellum; the other was described as a small, reddish brown tumor in the left and central lobes of the cerebellum, adjacent to the roots of the seventh and eighth cervical nerves. Feldman, in his monograph on neoplasms of domesticated animals, mentions no new cases. Because of this seemingly infrequent occurrence of intracranial neoplasms in lower animals, the following cases are reported, one a cerebral glioma in a dog, and the other a pinealoma in a silver fox (Vulpes fulvus).

CASE 1: On June 10, 1934, a spayed female Boston terrier dog was brought to one of us (C. F. S.) because of a sudden severe illness which had been present for six days. She was a pampered house pet, seven years of age and well nourished. There was no history of a previous severe illness. Her owner stated that on June 4 she had had a sudden severe convulsion. She had regained consciousness very slowly and had experienced two more severe convulsions later during that day. At no time following the first convulsive attack had she appeared entirely normal. At the suggestion of a neighbor she

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had been treated for intestinal parasites. As there was no change in her condition the following day, she had been given further treatment for worms. This had been without apparent benefit. She had refused to eat or drink, and had shown progressive weakness. The convulsions had recurred almost daily, and the periods of unconsciousness had increased in length.

FIG. 1. BRAIN OF DOG SHOWING AREA OF DESTRUCTION BETWEEN RIGHT TEMPORAL LOBE AND BASAL NUCLEI. (PHOTOGRAPH FROM CAUDAL DIRECTION)

It is difficult to distinguish neoplasm from surrounding tissue, except by destruction. The lesion simulates an infarct.

FIG. 2. AREA OF DESTRUCTION OF INFERIOR TEMPORAL GYRUS, HIPPOCAMPUS, AND AMYGDALOID NUCLEUS IN BRAIN OF A DOG

There is also some invasion of the lenticular nucleus. Weigert’s myelin sheath stain.

On examination the animal was in a stuporous condition, her pulse was feeble, and her temperature was 100.8° F. Twitching of the muscles of her legs and neck, similar to post-distemper chorea, was noted. The pupils of her eyes were unequally dilated and did not respond to light. She was dyspneic and in an apparent terminal state. She died within two hours.

Necropsy revealed lesions in the brain only. When the cranium was opened, a
Fig. 3. Photomicrograph of section of glioma which has been stained with hematoxylin and eosin to demonstrate variation in size of nuclei and in size of cell bodies.

Several multinuclear giant cells can be seen. There is some edema of the neoplasm. × 340.

Fig. 4. Photomicrograph of section of glioma.

Section has been stained with the silver-impregnation method and reveals axis-cylinders coursing through the tumor. Most of these are fragmented and degenerating in this area. Section stained with modified Orlandi method. × 340.
marked difference in appearance of the two cerebral hemispheres was observed. The vessels on the right hemisphere were full and plainly visible, while those on the left hemisphere appeared to be collapsed, giving this side of the cerebrum an anemic appearance. There was evidence of increased intracranial pressure, but the convolutions were more flattened on the right side than on the left.

The brain was removed and fixed in 10 per cent formalin solution. It was then sectioned across at intervals of about 1 cm. When this was done, a softened area with some central necrosis was observed in the lower posterior portion of the left frontal lobe and anterior portion of the temporal lobe. The entire area could be easily outlined by palpation (Fig. 1). This lesion also seemed to have involved the thalamus, lenticular nucleus, caudate nucleus, and the internal capsule.

Large sections of the brain, which were stained with the Weigert myelin sheath stain (Fig. 2), show destruction of the myelin sheaths of the basofrontal convolutions. These large sections also show that the tumor has invaded the anterior portion of the temporal lobe, and that it has extended deeper into the hemisphere than was first apparent, although many of the myelin sheaths are preserved. These sheaths are separated by the invading neoplasm, and many are undergoing active degeneration, as is evidenced by the beading and fragmentation of the myelin. Smaller sections of the neoplasm, which were stained by routine methods, show it to be very cellular and somewhat edematous. Most of the cells are small, with numerous loose, interlacing processes, giving it a reticulated appearance. The majority of the nuclei are small and stain deeply with hematoxylin, but many are larger and some giant nuclei are present, and multinucleated giant cells occasionally are seen (Fig. 3). In spite of the irregularity of the size of the cells and their nuclei and the presence of many hyperchromatic nuclei, very few mitotic figures are observed. With glial stains, it is seen that in some areas glial fibrils are present, and that none of these fibrils originate in the neoplastic cells, but that they originate from normal astrocytes which are included in the growth. Even occasionally, degenerating ganglion cells are included. There is no proliferation of the endothelial cells lining the dilated

![Fig. 5. Photograph of brain of silver fox showing large size of pineal tumor](image)
blood vessels or capillaries (Fig. 4). Silver stains for axis cylinders show many coursing through the neoplasm, but most are present near its periphery, although a few are seen in the center of the tumor. Most of the latter are fragmented and are degenerating.

This neoplasm belongs to the glioma group of tumors of the nervous system and because of the irregularity in the size of the nuclei, and occasional giant cells, we have classified it as a glioblastoma multiforme. The majority of the tumor cells are protoplasmic astrocytes, and it is probable that the tumor started as a protoplasmic astrocytoma and reverted to a spongioblastoma multiforme. This type of neoplasm is encountered not uncommonly in human beings.

**Case 2:** This was a pinealoma in a silver fox (*Vulpes fulvus*). The brain bearing the pineal tumor was collected by Dr. J. E. Shillinger of the Bureau of Biological Survey. It was removed from a silver fox on a fox ranch in Ohio. Disease of the central nervous system was suspected in this animal, although a record of the symptom syndrome was not obtained. This is unfortunate, as this apparently is the first case of pinealoma observed in a lower animal.

On examination of the brain, increased intracranial pressure was evidenced by the flattening of the convolutions and almost complete obliteration of the sulci. Between the posterior poles of the cerebral hemispheres at their lower borders was a grayish white tumor of firm consisteny (Fig. 5). It was attached by a peduncle to the region of the pineal body, which could not be identified. The tumor was oval in shape, slightly lobulated, and was surrounded by a smooth capsule. It had projected downward and compressed and distorted the cerebellum, which was approximately the same size as the tumor. The tentorium had been removed, so that we could not determine whether the neoplasm was supratentorial or infratentorial.

Histologic study of the neoplasm showed it to be a typical pinealoma, which was
Fig. 7. Photomicrograph illustrating excess of connective tissue in a slowly growing pinealoma

Section stained with van Gieson's method. × 115

Fig. 8. Photomicrograph of Pinealoma

The excess of connective tissue, which is collected in bands that have a tendency to surround islands of neoplastic tissue, is illustrated even better in this figure than it is in Fig. 7. Section stained with Perdrau's method. × 130.
composed of two types of neoplastic cells. The majority of the cells contained large, rounded nuclei and abundant cytoplasm, but there were many collections of small lymphocyte-like cells which were scattered irregularly through the tumor (Fig. 6). The nuclei of the large cells varied much in size and in the amount of chromatin they contained, but there were very few mitotic figures, and no multinucleated giant cells were present. The cytoplasm of these cells was as a rule abundant and was eosinophilic, but in some of the cells the cytoplasm was vacuolated. The contents of the vacuoles could not be determined, since they did not give a positive reaction for mucous or glycogen-like substances. The nuclei of the small cells were more uniform in size and stained deeper with hematoxylin than those of the larger cells, but again no mitotic figures were visible in this group. The nuclei were larger than those of lymphocytes and stained less deeply with hematoxylin. There was a thin ring of pale-staining cytoplasm surrounding the nuclei. Throughout the neoplasm was abundant connective-tissue stroma, staining red with van Gieson's stain (Fig. 7). This stroma, as demonstrated with Perdrau's silver impregnation method (Fig. 8), had divided the tumor into small islands of cells. Some of the larger cells had processes which intermingled with the stroma, but these processes did not stain in a differential way. There was no proliferation of the endothelial cells of the blood vessels.

This is a typical pinealoma such as is found in human beings, and with this we must compare it, since there has been no account of a similar neoplasm in lower animals. The two types of cells are practically pathognomonic of pinealomas, as are also the collections of lymphocyte-like cells. The manner in which the stroma separates the larger cells into small islands is also characteristic of this type of tumor. The location of the tumor, its attachment by a pedicle to the usual site of the pineal body, and the total absence of this structure are supporting evidence in favor of the neoplasm being a pinealoma.

BIBLIOGRAPHY