concurrent infection with *Torulopsis glabrata* in a dog. Pre-disposing factors included a history of chronic skin disease of obscure origin treated with antibiotics and/or corticosteroids for 6 months. Laboratory findings, sebaceous gland atrophy, epidermal atrophy, and epidermal hyperkeratosis were all findings that were consistent with those of corticosteroid effects. The immune status of this dog was unknown, but immunosuppression due to prolonged corticosteroid therapy was likely. Although there was no history of a puncture wound or other cutaneous trauma, the skin is the most probable site of origin of the infection, with subsequent hematogenous or lymphatic dissemination to other organs. Organisms compatible with *T. glabrata* were identified in lung sections, and *T. glabrata* was cultured from multiple sites. This infection may have represented a terminal fungemia in a dog with fatal primary disseminated phaeohyphomycosis.

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**References**


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**Astrocytoma in a Cynomolgus Monkey (Macaca fascicularis)**

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**Key words:** Astrocytoma; cynomolgus monkeys.

Only a few spontaneous tumors in the central nervous system of nonhuman primates have been reported. This report describes a necropsy case of astrocytoma in the brain of a female cynomolgus monkey approximately 18 years of age.

A female cynomolgus monkey (*Macaca fascicularis*) that was caught in the wild was purchased when it was approximately 3 years of age from a commercial supplier in October 1974. The monkey was maintained for 13 years for breeding purposes in our laboratory. Laboratory monkeys were housed in male/female pairs in stainless steel cages and fed commercial monkey food (PS: Oriental Yeast Co., Tokyo) and fresh fruits.

In June 1987, loss of appetite and decreasing food intake were noted, and she became less active and showed signs of depression. Body weight decreased slowly from 3.7 kg to 2.5 kg until she died on 10 December while in a coma. The hemogram and serum biochemical profiles of the blood taken from the moribund animal were within the normal ranges. The brain and other organs were fixed in 10% neutral buffered formalin and were sliced into samples 5 mm in thickness, which were subjected to soft X-ray micrography. The tissues were then embedded in paraffin, cut 5 μm, and stained with hematoxylin and eosin (HE). Selected sections of the brain were also stained with periodic acid-Schiff (PAS) and phosphotungstic acid-hematoxylin (PTAH). For immunohistochemical demonstration of glial fibrillary acid protein (GFAP), S-100 protein, and neuron specific enolase (NSE), the peroxidase-antiperoxidase (PAP) technique was applied using commercial kits (Dako Co., Santa Barbara, CA). For electron microscopic examination, formalin-fixed tissues were refixed with 2% phosphate buffered glutaraldehyde and 1% osmium tetroxide and routinely processed.

At necropsy, gross findings were observed in the brain and spleen. The spleen was slightly atrophic and weighed 5 g. The brain weighed 57.6 g and contained a nodular pinkish-grey mass (1.5 x 1.5 x 2 cm) that involved a majority of the left temporal lobe (Fig. 1). There was no obvious demarcation between the mass and adjacent tissues. Soft X-ray examination of the slice of the brain revealed an ill-defined homogeneous mass in the temporal lobe (Fig. 2). No encapsulation, cyst formation, or calcification was seen in the tumor mass. The extended mass compressed the surrounding brain tissue and the third ventricle, resulting in an asymmetrical brain.

Microscopically, the tumor growth in the left temporal lobe...
Fig. 1. Brain; cynomolgus monkey. Gross appearance of the tumor mass in the left temporal lobe (arrowheads).

Fig. 2. Soft X-ray micrograph. Brain; cynomolgus monkey. Same slice as in Fig. 1. A tissue slice containing the poorly demarcated mass (arrowheads), which has expanded the left temporal lobe.

Fig. 3. Brain; cynomolgus monkey. Diffusely arranged fibrillary astrocytic tumor cells. HE. Bar = 80 μm.

Fig. 4. Brain; cynomolgus monkey. Slightly atypical astrocytic cells in the deeper portion of the tumor. Note multinucleated cell (arrow). HE. Bar = 30 μm.
showed no extradural or extracranial spread. The tumor was composed predominantly of fibrillar astrocytes with eosinophilic cytoplasm that formed a cell process network (Fig. 3). Protoplasmic or gemistocytic cells were occasionally observed. The tumor cells infiltrated diffusely from the mass to the surrounding tissue. In the superficial portion of the tumor, cellular density was rather low, and normal-sized fibrillary cell types with some microcysts were prominent. In the deeper portion of the tumor, the cell population was more dense and the cells showed some atypia. The nuclei with distinct nucleoli were slightly larger and showed variation in size and shape. Binucleated or multinucleated cells were sometimes observed (Fig. 4). Mitosis was infrequent. The tumor cells contained fine PTAH-reactive fibrils that were numerous at the cell periphery (Fig. 5). The long processes of these neoplastic astrocytes usually terminated on the vessel wall. Most fibrillary or gemistocytic tumor cells were immunohistochemically positive for human GFAP and S-100 protein (Figs. 6, 7). Fibrillary processes stained more strongly with anti-GFAP than anti-S-100. The positive reaction for GFAP in the cytoplasm of tumor cells provides strong evidence for their astrocytic origin, because GFAP is absent in oligodendroglial, neuronal, and meningiothelial cells.\textsuperscript{3,4} Some nerve cells in the periphery were NSE positive.

Electron microscopic examination revealed glial filament bundles in the perikaryon and cytoplasmic processes, which terminated on the vessel wall (Fig. 8).

A moderate decrease in white pulp was observed in the spleen. Other organs showed no significant changes.

Human astrocytomas have been graded from 1 (well differentiated) to 4 (undifferentiated), according to cytologic criteria.\textsuperscript{t,i} The present case has the histologic characteristics of a human well-differentiated astrocytoma (grade 1 or 2), which occurs more frequently in adults than children and accounts for 25-30% of all gliomas.\textsuperscript{3} In human adults, a cerebral hemisphere, especially the temporal lobe, is usually affected, whereas the cerebellum is the preferred location in children.\textsuperscript{i} The present case of a simian astrocytoma was cellular and formed a large mass with a tendency toward expansion, characteristics that are highly comparable to those of human astrocytomas.

McClure reported one glioblastoma in the cerebrum of a 14-year-old rhesus monkey (Macaca mulatta) out of a total of 1,066 necropsied nonhuman primates.\textsuperscript{7} A glioblastoma was also described in the cerebrum of a 15-year-old female baboon (Papio anubis);\textsuperscript{1} however, there have been no earlier reports on well-differentiated astrocytomas in nonhuman primates.

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References


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Fig. 5. Brain; cynomolgus monkey. Astrocytic tumor cells with numerous phosphotungstic acid-hematoxylin (PTAH)-reactive fibrils. PTAH. Bar = 30 \mu m.

Fig. 6. Brain; cynomolgus monkey. Glial fibrillary acid protein-positive cytoplasm of the tumor cells. Peroxidase-antiperoxidase technique. Bar = 30 \mu m.

Fig. 7. Brain; cynomolgus monkey. S-100-positive cytoplasm and nucleus. Peroxidase-antiperoxidase technique. Bar = 30 \mu m.

Fig. 8. Electron micrograph. Brain; cynomolgus monkey. Intracytoplasmic glial filaments of the tumor cell are indicated by the arrows. Nucleus (N). Bar = 1 \mu m.