Ganglioglioma of the Spinal Cord in a Calf

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A ganglioglioma is a tumor consisting of neuronal cells in various degrees of differentiation mixed with glial elements which may participate in the neoplastic process.\(^2\)\(^4\) Gangliogliomas are rare in man\(^2\)\(^4\)\(^2\) and domestic animals.\(^1\) In man, they usually present in the cerebrum of a child or young adult and are rarely found in the spinal cord.\(^2\)\(^4\) In domestic animals gangliogliomas have been documented in unusual sites, e.g., an intraocular tumor in the dog,\(^4\) but not in the spinal cord.

A Holstein steer, normal at birth, was weak and ataxic in both rear limbs at 3 months of age. By 4 months of age, the calf was paraplegic. Temperature, pulse, and respiratory rates were normal. Withdrawal reflexes in the front and rear limbs were considered normal during neurologic examination. Patellar reflexes were hyperactive (3+/4). Anal reflex and tail tone were normal. The steer required assistance to stand, and at a walk, the front limbs appeared normal, but the hindlimbs were markedly weak and ataxic. Lateral radiographs of the thoracolumbar vertebral column appeared normal. Analyses of cerebrospinal fluid aspirated from the atlanto-occipital and lumbosacral spaces were normal. The calf was euthanized.

Moderate muscle atrophy of both hindlimbs was present at necropsy. A 1 x 3 cm red-tan mass was within the spinal cord between T12 and L1. It was moderately firm, caused distortion of the surrounding spinal cord, and could not be easily separated from the adjacent parenchyma. Sections of the mass, spinal cord, and major organs were fixed in 10% neutral buffered formalin, embedded in paraffin, and sectioned at 4 to 6 \(\mu\)m. Sections were stained with hematoxylin and eosin (HE) for light microscopic examination. Other sections of the mass and spinal cord were examined using the Bielschowsky silver method and by immunoperoxidase techniques using monoclonal antibody against the 200 KD neurofilament protein subunit and a polyclonal antiserum against glial fibrillary acid (GFA) protein.

The neoplasm consisted of several cell types characteristic of ganglioglioma (Fig. 1). Some cells had typical neuronal nuclei which were large, vesiculated, and eccentrically located with distinct nucleoli. In some cells Nissl substance was present. The ganglionic nature of these cells was confirmed by Bielschowsky silver impregnation for neurites (Fig. 2), and neuronal processes were also immuno-positive with the neurofilament protein monoclonal antibody. Variation in size and shape of these cells, some of which were binucleate, random orientation, and abundant tortuous neurites indicated that they were neoplastic and not pre-existing neurons entrapped by tumor cells. A second group of cells were neoplastic astrocytes which were immunopositive for GFA protein (Fig. 3). In addition to these two types of cells, there were also smaller cells with small darkly staining nuclei and scanty cytoplasm, resembling lymphocytes (Fig. 1) that are commonly seen in gangliogliomas. The identity of these cells is not clear, but they are believed to be either neuroblasts (presumably the source of the larger more mature ganglion cells), or small adult granular neurons. Likewise, the small cells with delicate nuclear chromatin and small nucleoli are also thought to be ganglion cell precursors.\(^4\)

It is not clear whether ganglioneuromas arise from primitive neuroepithelial cells committed to divergent neuronal and glial differentiation, or from pre-existing mature cells which have resumed replication.\(^4\) Normal mature neurons do not divide. Tumors consisting of neuronal or neuron-committed cells are usually divided into those of a more primitive type, including medulloblastoma and neuroblastoma, and those of an adult type, including ganglioneuroma and ganglioglioma. It is important to distinguish between these two categories as the primitive type pursues a more malignant course while the adult type has a favorable prognosis.\(^4\) In gangliogliomas the outcome depends on the de-
development of anaplasia in the glial elements because ganglionic elements are virtually always benign. Anaplasia in gangliogliomas is rare.3

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References


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Fig. 1. Ganglioglioma. Cells with large vesiculated nuclei and prominent nucleoli are mature ganglionic cells. HE.

Fig. 2. Ganglioglioma. Silver impregnation, abundant tortuous neuritic processes. Bielschowsky silver stain.

Fig. 3. Ganglioglioma. Darkly staining cells with processes are neoplastic astrocytes immunopositive for glial fibrillary acidic protein. Immunoperoxidase for glial fibrillary acidic (GFA) protein, hematoxylin counterstain.