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SPONTANEOUS ASTROCYTOMA IN THE MONGOLIAN GERBIL (*MERIONES UNGUICULATUS*)

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Spontaneous neoplasms of the central nervous system in gerbils are unknown. After introduction of a Mongolian gerbil into laboratory use (Schwentker 1963) it was suggested that these rodents do not develop spontaneous tumors (Handler, Pav 1964; Handler et al. 1966). Soon both in the Mongolian gerbil and in some few species of wild and laboratory-bred *Gerbillinae* neoplasms of the skin and internal organs were noted (Benitz, Kramer 1965; Ringler et al. 1972; Rowe et al. 1974; Vincent, Ash 1978). The tumors were observed in 8.4—24% of autopsied animals (Vincent et al. 1979) particularly in ageing, more than 2-year-old animals (Rowe et al. 1974; Vincent et al. 1975).

This paper concerns a primary spontaneous glioma of the medulla oblongata, the first noted case of a neoplasm of the central nervous system in the Mongolian gerbil.

CASE HISTORY

An 8-week-old male Mongolian gerbil, No. 47/80 was raised in our own colony from the group of Mongolian gerbils obtained in 1974 from Albert Einstein Institute, originating from Tumblebrook Farm, Brant Lake, N. Y. The animal, together with other 22 gerbils in this series was user for experimental brain ischemia by one the authors (M. J. M.) and included into the published study (Kapuściński, Mossakowski 1983). The gerbil had been anesthetized with ether and both common carotid arteries were occluded with Heifetz clip for 30 min. On account of the shallow respiratory action, the respiratory pump was introduced since the 15th minute of the experiment. The survival time after release of the carotid clamping was 2 hr. The animal was perfused successively with physiological saline and with 10% formalin solution. At necropsy the condition of internal organs was good. The brain was cut frontally at the level of basal ganglia, Ammon horns and cerebellum. The ventricular system was dilated. Cerebral cuts were fixed in 10% formalin and

embedded in paraffin. Tissue sections 10 μm thick were stained with hematoxylin and eosin and by the methods of Klüver-Barrera, Holzer, Bielschowsky, Gridley, PAS. Additionally, immunoperoxidase method with rabbit anti-GFAP serum (Decopatts, Danmark) in dilutions 1 : 500, 1 : 200, 1 : 100 and goat anti-rabbit IgG conjugated with peroxidase (Behringwerke, FRG) was applied to paraffin sections.

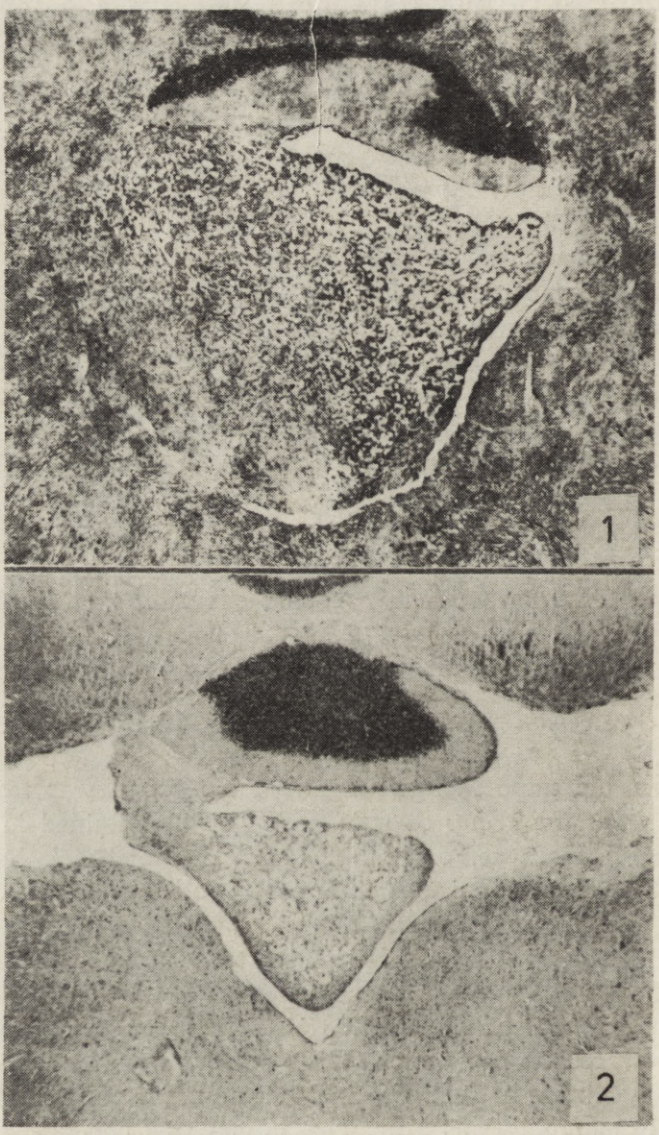

Fig. 1. Subependymal localization of the tumor in the floor of the IVth ventricle. H—E. × 25

Ryc. 1. Guz podwyściółkowy w dnie IV komory. H—E. Pow. 25 ×

Fig. 2. Tumor in the lumen of the IVth ventricle. H—E. × 25

Ryc. 2. Guz w świetle IV komory. H--E. Pow. 25 ×

CASE DESCRIPTION

In the cerebral hemisphere vacuolization of neuropil of anterior parts of *thalamus opticus*, particularly enhanced in the posterior parts. Hippocampal gyri exhibit marked rarefaction of neuropil and numerous eosinophilic cells between sector H_2 and H_3.

Cerebellar sections reveal a neoplasm localized at the floor of the IVth ventricle in midline opposite to the nodulus (Fig. 1). In the medulla oblongata it occupies both *fasciculi longitudinales mediales* reaching laterally *nucleus vestibularis* neurons which extend to the periphery of the tumor. Small fiels of neoplastic tissue infiltrate bilaterally *pedunculi cerebellares* inferiores. Some sections show the tumor invading the ventricle subependymally, other — inside the ventricle (Fig. 2).

The main mass of the tumor is well delimited from the nervous tissue despite of infiltrative type of growth (Fig. 3). There are two basic types of cells, i.e. small and large ones with moderate chromatic, medium size nuclei and abundant cytoplasm (Fig. 4). The nuclei with clear-cut nucleoli are placed excentrically. Bi- and trinuclear cells with distinct, granular chromatin are present. The cytoplasm of large cells is markedlly eosinophilic with vacuoles and sometimes with round inclusions staining pale blue with cresyl violet, negative with PAS. The outline of the cells is irregular with short processes (Fig. 5). Some cells are triangular with one broad process. There are also some large dispersed cells with content was hed out (Fig. 6). Small cells with hyperchromatic nuclei and scarce cytoplasm are spread among the large cells. Mitotic figures are absent.

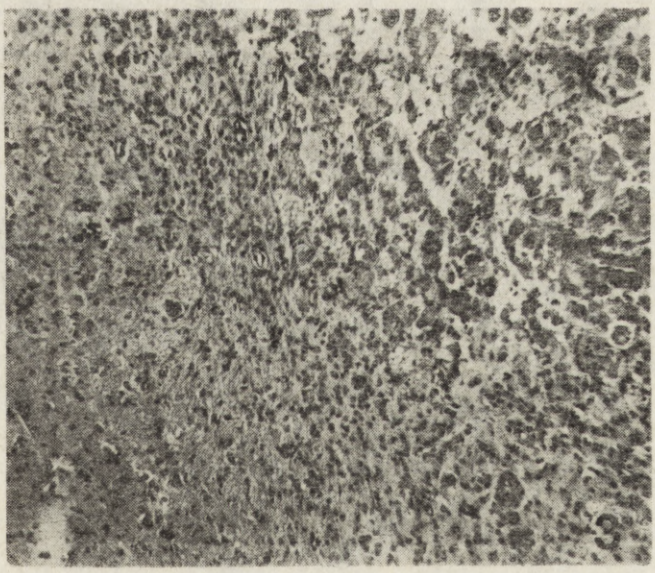

Fig. 3. Periphery of the tumor and delineation from neurve tissue. H--E. × 60
Ryc. 3. Pogranicze nowotworu i tkanki nerwowej. H—E. Pow. 60 ×

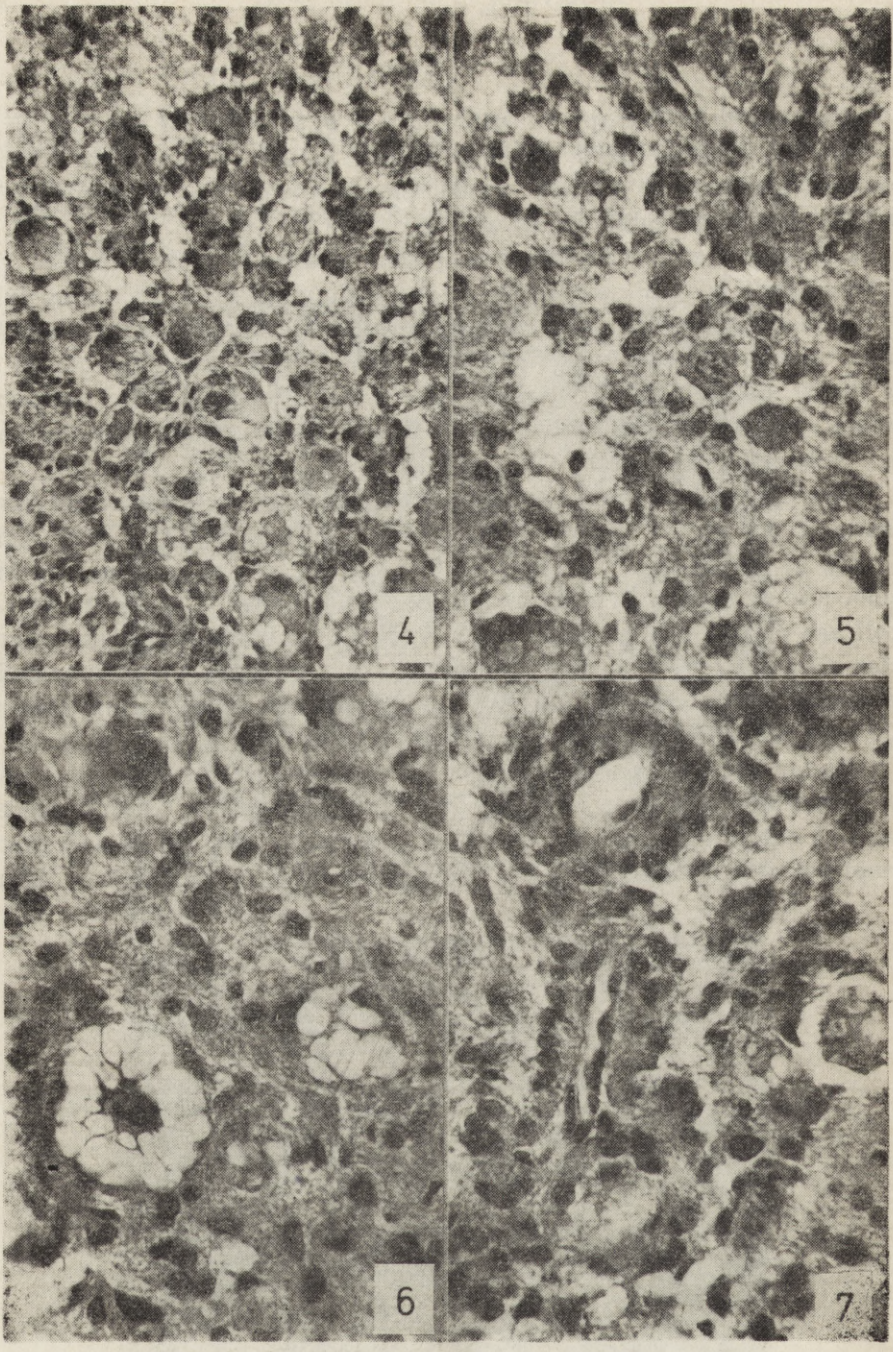

Fig. 4. Large neoplastic cells with excentric nuclei. H—E. × 100

Ryc. 4. Duże komórki nowotworowe o jądrach ułożonych na obwodzie. H—E. Pow. 100 ×

Fig. 5. Vacuolization of large neoplastic cells. H—E. × 250

Ryc. 5. Wakuolizacja dużych komórek nowotworowych. H—E. Pow. 250 ×

Fig. 6. Degeneration of neoplastic cells. Note the binuclear, polymorphic cell. H—E. × 400

Ryc. 6. Zwyrodnienie komórek nowotworowych i komórka dwujądrzasta, wielokształtna. H—E. Pow. 400 ×

Fig. 7. Perivascular arrangement of small neoplastic cells. H—E. × 400

Ryc. 7. Okołonaczyniowy układ małych komórek nowotworowych. H—E. Pow. 400 ×

There are traces of gial fibrils. Tumoral vessels are few, thinwalled and of small diameter with tendency to be surrounded by small neoplastic cells (Fig. 7). Reticulin fibres are not present either in the vascular walls or neoplastic stroma. There were neither necrotic nor hemorrhagic foci. The majority of neoplastic cells had their cytoplasm immunostained with anti-GFAP serum diluted 1 : 100; in higher dilutions stained only a few large cells (Fig. 8). The diagnosis was additionally supported by the reprint from the personal computer "JJJ" in the Institute of Neuropathology, Free University, West Berlin programmed for diagnostics of human brain tumors (Iglesias et al. 1983, 1986). Assuming that the large cells of the tumor orginate from astrocytes, the probability of diagnosis of astrocytoma is 98.87%. If the large cells are of neuronal origin the probability of the diagnosis of astrocytoma is 66.05%, oligodendroglioma 31.33%, ependymoma 1.47%, unclassified tumor 1.10%.

DISCUSSION

Comparison of this unique case with other similar cases of spontaneous gliomas cannot be done. Intracerebral inoculation of 1-day aged Mongolian gerbils with Avian sarcoma virus (ASV) caused intracerebral gliomas, fatal in 38.4 ± 10.9 days in 100% of animals. The tumors were invasive, hemorrhagic, composed of oligodendroglia, gemistocytic and protoplasmatic astrocytes (Serano, Bigner 1979). One of the most popular carcinogens for the nervous system, ethylnitrosourea, administered subcutaneously to neonatal Mongolian gerbils caused after a year in 31%

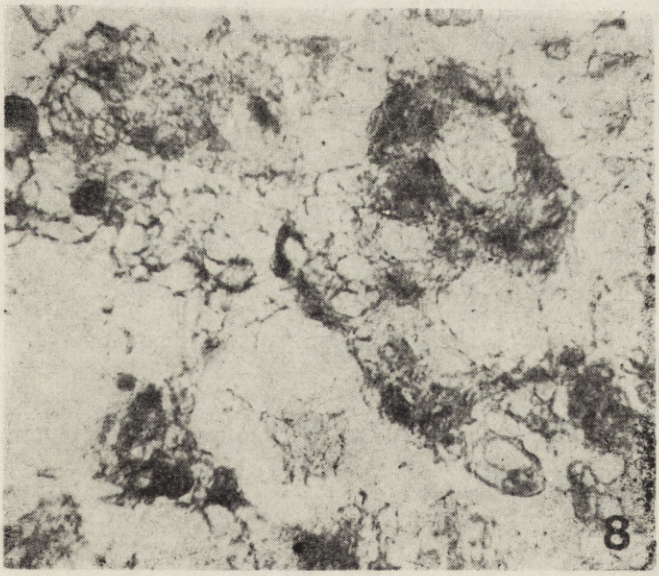

Fig. 8. Distribution of GFAP in neoplastic cells. Rabbit anti-GFAP serum, 1 : 100 dilution. × 400

Ryc. 8. Zawartość GFAP w komórkach nowotworu. Surowica królicza anty-GFAP w rozcieńczeniu 1 : 100. Pow. 400 ×

of animals the oligodendrogliomas of the brain and spinal cord and one meningeal tumor with addition of cutaneous melanomas, kidney hemangiomas and ameloblastomas of the lower jaw. (Naito et al. 1985) or only melanomas of the skin (Kleihues, et al. 1978), whereas methylnitrosourea induced adenomas and carcinomas of the midventral sebaceous gland (Haas et al. 1975a). Diethylnitrosamine provoked in gerbils exclusively carcinomas of the liver and respiratory system (Haas et al. 1975b). None of the mentioned carcinogens produce in gerbils tumors of the peripheral nervous system, popular in other species, though there is a published case of a gerbil (*Meriones Shawi*), less than 46 months old which developed within one year a neurilemmoma of the brachial plexus (Ringler et al. 1972).

The animal presented by us seems to be the youngest tumor-bearing gerbil. Only twice were noted tumors of internal organs in gerbils younger than 2 years: a 5-month-old gerbil with ovarian teratoma (Meckley, Zwicker 1979) and 1.5-year-old one with thyroid adenoma (Shumaker et al. 1974).

Spontaneous cerebral and cerebellar gliomas in laboratory animals, dogs excepted (Dahme, Schiefer 1960), are rather rare. Singular astrocytomas developed in cats (Luginbühl et al. 1968). Among rare spontaneous intracerebral tumors in rats, astrocytomas are most frequent, including multifocal ones (Fitzgerald et al. 1974). Only one case of cerebral unclassified glioma was observed in the golden hamster (Luginbühl 1964) whereas spontaneous brain tumors in guinea pigs and in ferrets are unknown (Jänisch, Schreiber 1969).

As neither histological classification of brain tumors in gerbils, nor the computer programme for animal tumors are established, classification of the astrocytoma in question was difficult. Relatively sharp delineation of the growth and its localization in the medulla oblongata are atypical. The sparse amount of tissue did not allow to perform impregnation on frozen sections. The histological features of the large neoplastic cells require differentiation from those of neuronal origin; the diagnosis of ganglioglioma has been excluded by the personal computer.

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SAMOISTNY GWIAŹDZIAK U CHOMIKA MONGOLSKIEGO

Streszczenie

Przypadek dotyczy 8-tygodniowego chomika mongolskiego, u którego stwierdzono gwiaździak rdzenia przedłużonego w pobliżu IV komory. Nowotwór ten jest pierwszym samoistnym gwiaździakiem napotkanym w OUN chomika mongolskiego. Rozpoznanie histologiczne opiera się dodatkowo na wydruku z komputera programowanego dla ludzkich nowotworów mózgu.

СПОНТАННАЯ АСТРОЦИТОМА У МОНГОЛЬСКОГО ХОМЯКА

Резюме

У 8-недельного монгольского хомяка обнаружено астроцитому продолговатого мозга в близи IV желудочка. Эта опухоль является первой спонтанной астроцитомой, встреченной в центральной нервной системе монгольского хомяка. Гистологический диагноз основан добавочно на результатах компутера, программированного для неоплазм мозга человека.

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