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Further Studies on Neurohistological Changes in the Central Nervous System of Cattle Affected with Paresis Spastica

Dalsze badania nad zmianami neurohistologicznymi w ośrodkowym układzie nerwowym przy *paresis spastica* u bydła

Дальнейшие исследования неврогистологических изменений в центральной нервной системе при *paresis spastica* у скота

The present paper deals with the central nervous system of the bull "Arnold 224 G" with paresis spastica of the hind legs. The bull, of the Lowland Black-and-White breed, was born on 11th December, 1964 and slaughtered on 21st January, 1970. The animal was descended from the genetic line Annas Adema 30587 and related to the bulls "Jupiter 185 G", "Julius 184 G" and "Ramzes 223 G", in which the symptoms of paresis spastica were also found. Their common progenitor was "Jelsumer Gerard 15" related to Annas Adema 30587 by "Jelsumer Gerard Diamant 46897"—"Amarilla Annas Diamant 241071"—"Diamant 33251". In this line, clinical examinations revealed paresis spastica in many individuals.

The bull "Arnold" was bought for the State Insemination Centre at Sztum in April, 1966. At first, except for a slight erection of the legs in the tarsal articulations, the animal's posture and gait did not reveal any signs of the disease. Symptoms typical of paresis spastica developed in the bull about 6 months before the slaughter. On the day of slaughter, pathogenic symptoms were advanced and manifested themselves by a supererectile position of the tarsal articulations and permanent rigidity of the hind legs. Owing to this unphysiological, supererectile position of the tarsal articulations, the leg outline lacked clearly marked calcaneous tubers. Achilles tendons were tense and strong spastic contraction of *musculus gastrocnemius* and *quadriceps femoris* was observed. The hind legs were pushed forward and the back was slightly arched (Fig. 1). The gait of the animal was stiff and the step short and cut. While standing, the bull often shifted his body weight from one hind leg to the other which, in turn, he took back. The tarsal articulation of this leg was always in a supererectile position. The bull often lay down and had difficulties with rising. Both his hind legs showed symptoms of paresis spastica.

During section, no anatomic-pathologic changes were found in the internal organs, muscles and legs. Radiological examination did not reveal any changes in the bones of the tarsus, *extremitas distalis* of the tibial bones and *extremitas proximalis* of the metatarsal bones.

MATERIAL AND METHODS

The brain, which immediately after slaughter was injected through the *arteria carotis communis* with 10% solution of neutralized formalin and then fixed in the same solution for 6 weeks, was taken for neurohistological examination. The brain stem, cerebellum and subcortical part of the telencephalon were cut into 15 μ thick transverse sections. Every 10th section, stained according to Klüver-Barrera, was examined.

RESULTS

In the reticular substance of the medulla oblongata, "spotty" cells occurred (Fig. 2). Spottiness of the cells was due to the disappearance of the granules of tigroid substance in some regions. The "spotty" cells were found only in the reticular substance on the left side of the medulla oblongata.

Similar cells with spots were also present in the left and right lateral vestibular nucleus (Fig. 3).

On the right side of the medulla oblongata, changes were observed in the cells of *nucleus olivaris accessorius medialis* (Fig. 4). The changes consisted in the concentration of tigroid in the periphery and disappearance of the granules of tigroid substance in the central part of cells. The abnormal cells were rather numerous and usually a few of them formed small groups among the normal cells.

In the area of the mesencephalon, the cells of both sides of the red nucleus were changed. However, more abnormal cells occurred in the red nucleus on the right side of the brain. The changes in the cells of this nucleus consisted in the presence of single vacuoles of various sizes, from small (Fig. 5) to very large ones filling almost the whole cell body and shaping it into a ring (Fig. 6). The cells of the right red nucleus were characterized by large vacuoles.

Some changes were also observed in the nerve fibres of the dorsal part of the extraventricular medulla oblongata segment. In contrast to the normal fibres, the abnormal fibres were of larger diameter often up to 35 μ and, in some places, they formed distinct bundles (Fig. 7).

In the internal capsule, on the left and right side of the brain there occurred small single foci of demyelination (Fig. 8). They were located more or less at the half of the capsule level. In the right internal capsule, there were also found single, not very large microglial infiltrations (Fig. 9). These infiltrations were situated in the gray sub-

stance, among the bundles of fibres. Glial infiltration was also present in the *corpus callosum*. It was astrocyte infiltration accumulated around a blood vessel (Fig. 10).

DISCUSSION

The paper presents the results of studies on the changes in the central nervous system of the eight bull in turn, which was affected with paresis spastica. In the main, the changes observed in the central nervous system of the bull "Arnold" were similar to those registered in other bulls by the workers of our Institute (2, 3, 6, 7, 8) and by other authors (1, 4, 5, 9, 10).

However, there were observed certain features which were characteristic of the changes in the brain of the bull "Arnold" only. Namely, in the lateral vestibular nucleus, hypochromasia of the cells was not found and, on the other hand, distinct "spotty" cells occurred there. In the cells of the red nuclei, single vacuoles of various sizes were present, whereas, in the brains of other bulls, beside single vacuoles, a few vacuoles in a cell were observed. In the bull "Arnold", microglial infiltrations were not numerous and, in other bulls, they appeared in a larger amount not only in the area of the internal capsule but also in the area of the subcortical nuclei. The perivascular astrocyte infiltration in the *corpus callosum* was found for the first time in the brain of the bull "Arnold".

EXPLANATION OF FIGURES

Fig. 1. The bull "Arnold".

Fig. 2. A cell of the reticular substance of the medulla oblongata.

Fig. 3. A cell of the lateral vestibular nucleus.

Fig. 4. Cells of the medial accessory olivary nucleus.

Fig. 5. A cell of the red nucleus (left side).

Fig. 6. A cell of the red nucleus (right side).

Fig. 7. Broad fibres in the dorsal region of the medulla oblongata.

Fig. 8. A bundle of demyelinated fibres in the internal capsule.

Fig. 9. Microglial infiltration in the internal capsule.

Fig. 10. Perivascular astrocyte infiltration in the *corpus callosum*.

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STRESZCZENIE

Od buhaja, u którego stwierdzono objawy *paresis spastica* obu kończyn tylnych, pobrano do badań neurohistologicznych pień mózgowia, mózdzek i część podkorową kresomózgowia. Materiał pobrany do badań utrwalano w zneutralizowanej formalinie, zatapiano w parafinie, cięto na skrawki poprzeczne grubości 15 u, a następnie barwiono wg metody Klüvera-Barrery.

Stwierdzono zmiany wsteczne w komórkach *substantia reticularis* rdzenia przedłużonego, *nucleus olivaris accessorius medialis*, *nucleus vestibularis lateralis* oraz *nucleus ruber*. Zaobserwowano także ogniska demielinizacji oraz pojedyncze nacieki mikrogleju w *capsula interna* oraz nacieki astrocytarny okołonaczyniowy w *corpus callosum*.

OPIS RYCIN

Ryc. 1. Buhaj „Arnold”.

Ryc. 2. Komórka *substantia reticularis* rdzenia przedłużonego.

Ryc. 3. Komórka *nucleus vestibularis lateralis*.

Ryc. 4. Komórki *nucleus olivaris accessorius medialis*.

Ryc. 5. Komórka *nucleus ruber* (strona lewa).

Ryc. 6. Komórka *nucleus ruber* (strona prawa).

Ryc. 7. Szerokie włókna w grzbietowej okolicy rdzenia przedłużonego.

Ryc. 8. Pęczek włókien zdmielinizowanych w *capsula interna*.

Ryc. 9. Naciek mikrogleju w *capsula interna*.

Ryc. 10. Naciek astrocytarny okołonaczyniowy w *corpus callosum*.

РЕЗЮМЕ

У племенного быка с симптомами *paresis spastica* задних конечностей брали для неврогистологических исследований мозговой ствол, мозжечок и субкортикальную часть конечного мозга. Этот материал фиксировали в нейтрализованном формалине, заливали парафином, разрезали на срезы толщиной 14 мк и окрашивали по методу Клювера-Баррери.

Инволюции обнаружили в клетках *substantia reticularis* продолговатого мозга, *nucleus olivaris accessorius medialis*, *nucleus vestibularis*, *nucleus ruber*. Обнаружили также очаги демиелинизации и одиночные инфильтраты микроглии в *capsula interna* и астроцитарные инфильтраты в *corpus callosum*.



Fig. 1

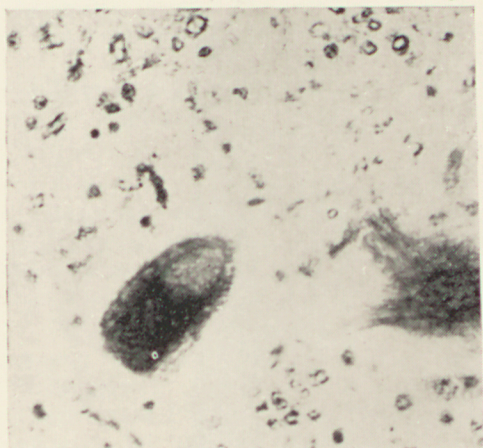


Fig. 2

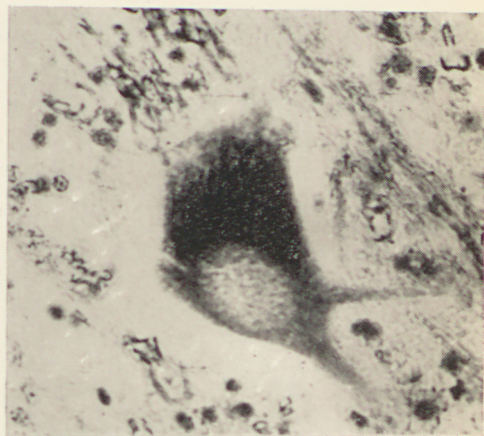


Fig. 3

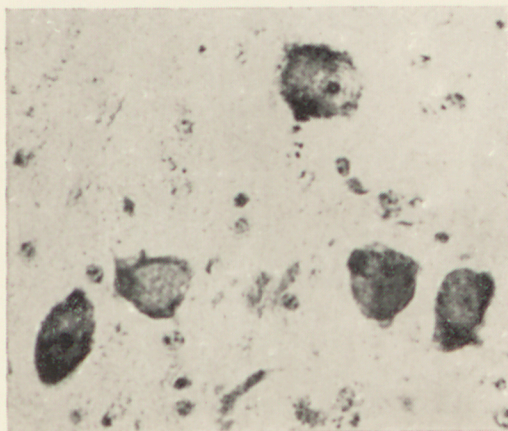


Fig. 4

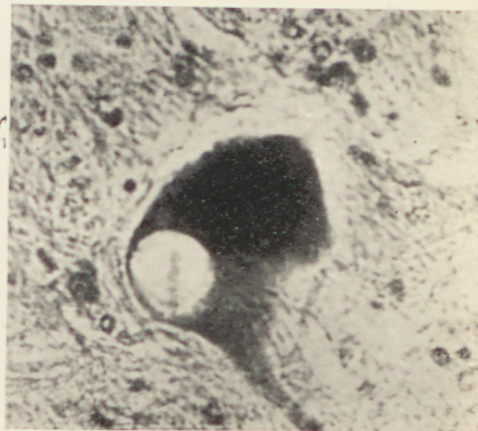


Fig. 5

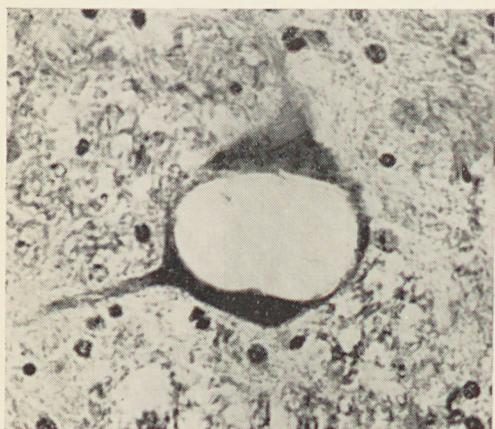


Fig. 6

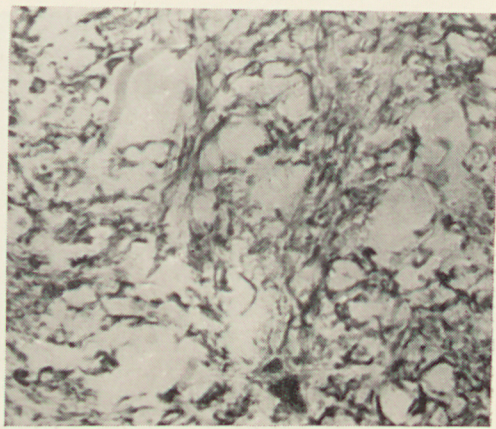


Fig. 7

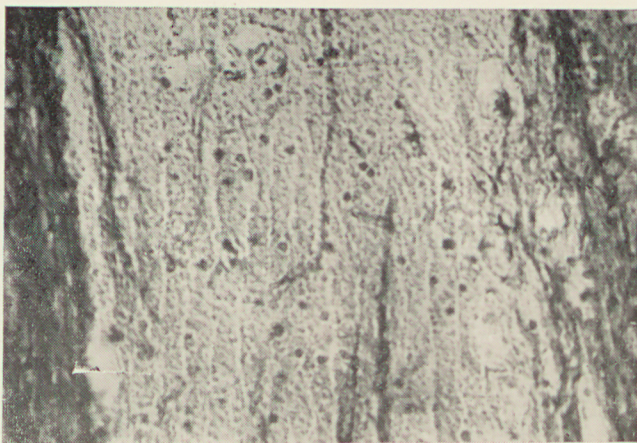


Fig. 8

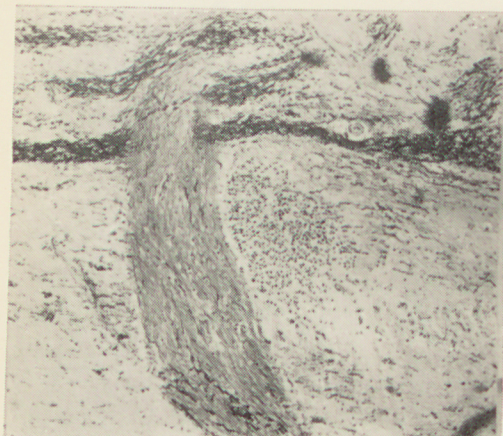


Fig. 9

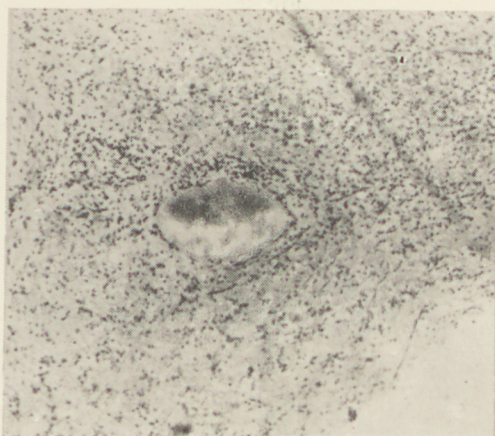


Fig. 10