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MORPHOLOGICAL CHARACTERISTICS OF GLIAL CELLS IN TELENCEPHALON OF *SCYLIORHINUS CANICULA*

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ABSTRACT

The different types of glial cells constitute quantitatively an important part of the central nervous system.

Adult dogfish, *Scyliorhinus canicula*, were anaesthetised in sea water with 0,017% MS-222, decapitated, the brain removed and 8 μm sections of telencephalon prepared according to the Cajls gold-sublimate method for astrocytes. For radial glial cells and alsou for astroglial cells we used the Golgi method.

In telencephalon of the Scyliorhinus canicula we distinguish several distinct astrocytic cell types associated with the blood vessels.

Some radial glial cells in Scyliorhinus canicula telencephalon extend from ventricular to pial surface. Other lose their outher contact with the pia and retain endfeet at the ventricular surface. Some radial glial cells translocate their body at various depths of telencehalic wall and form characteristic astrocyte and acquire bushy astrocyte like appendages.

Key words: *Scyliorhinus canicula*, telencephalon, glial cells.

MORFOLOŠKE KARAKTERISTIKE GLIJALNIH ĆELIJA TELENCEFALONA *SCYLIORHINUS CANICULA*

REZIME

Različiti tipovi glijalnih ćelija čine kvantitativno važan deo centralnog nervnog sistema.

Odrasli morski psi, *Scyliorhinus canicula*, anestezirani su u morskoj vodi, dekapitovane, mozak je izvađen i preseci telencefalona debljine 8 μm impregnirani metodom Cajal za astrogliju. Golgi metod smo koristili kako za astrogliju tako i za radijalnu gliju.

U telencefalonu *Scyliorhinus canicula* razlikujemo tri tipa protoplazmatične astroglije koja je povezana sa krvnim sudovima.

Prvi tip radijalne glije proteže se od ventrikularne zone do pialne površine i ne primećuje se da formira specifične kontakte sa krvnim sudovima. Drugi tip je svojim telom lociran na ventrikularnoj površini mozga i gubi kontakt sa pialnom površinom. Treći tip radijalne glije se nalazi na različitim dubinam telencefalona. Ćelije su slične astrocitima. Jedan nastavak im je duži i u kontaktu je sa krvnim sudom.

Ključne riječi: Scyliorhinus canicula, Telencephalon, glijalne ćelije

INTRODUCTION

The different types of glial cells constitute quantitatively an important part of the central nervous system. Astroglial cells are thought to be involved in the transport of water, electrolytes and metabolites within the brain and to be the site of an active homeostatic mechanism that regulates the content of water and prevents swelling of this tissue. The astrocytes are interposed between the neurons and the blood vessels.

In mammals, protoplasmic astrocytes are located primarily in the grey matter and according to Hortega (1919), we shall distinguish three types of protoplasmic astrocytes; those in intimate contact with nerve cells; an intermediate type; and these in intimate contact with blood vessels with by means of perivascular foot. The fibrous astrocytes in mammals are observed especially in the white matter. Two to three long processes from cell body sometimes being close contact with a blood vessels.

In higher invertebrates and elasmobranch fishes, the blood-brain barrier is formed instead by glial cells (Brightman et al., Bundgaard & Cserr, 1981). Astrocytic processes investing the capillary are linked by well-developed tight junctions between lateral membranes immediately beneath the perivascular space (Gotow & Hashimoto, 1984).

Radial glia cells provide the basic supporting framework of the nervous parenchyma. Radial glial cells are the earliest class of astrocytes to appear in all regions of the primate brain. In submammalian species, radial glial cells persist throughout life, while in mammals, these cells transform into fibrillary astrocytes, protoplasmic astrocytes or (in the cerebellum) into Bergmann glial cells. In fishes the basic supporting framework of the nervous parenchyma is provided by radial glia cells (Rakić 1984).

MATERIAL AND METHODS

Adult dogfish, *Scyliorhinus canicula*, for classical staining methods were caught in the Adriatic Sea off the coast near Kotor, Yugoslavia. Animals (28-45 cm, in length, weighing 180-300 gm) were anaesthetised with 0,017% MS-222 tricaine methane sulfomate (tricaine methane sulfomate, Sigma) and

perfused through the conus arteriosus with a selachian fixative. The brains were removed and the telencephalon processed by successful impregnations by Cajls gold-sublimate method or Hortegas triple impregnation method will give sufficient information for architectonic analysis of astroglial cells (Hortega 1918).

Some brains were processed by Golgi method (Rakić & Lazarević, 1977). Impregnated blocks were embedded in celloidin and frontal serial sections of 100 to 120μm thickness were cut.

RESULTS

In telencephalon of *Scyliorhinus canicula* several distinct protoplasmic astrocytic cell types can bee seen associated with the vessels. In the first type the cell body is located on vessel wall, and extends short, fine protoplasmic processes (Fig. 1, 2).

Figure 1. The cell body of astroglial cells are located on the blood vessels x 800.

Figure 2. Golgi preparated astrocytes

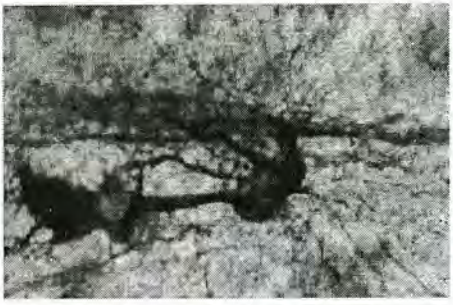

Figure 3. Astrocyt with cell body away from blood vessels x 800.

A second type has the cell body away from the vessel, but extends numerous processes, of rather variable diameter, onto nearby blood vessels. Some of the processes are particularly prominent, and show fine lateral projections from the expanded terminal regions (Fig. 3).

Figure 4. Long process of astrocytes. x 800

Figure 5. Golgi preparation of long process of astrocytes

A third type has the cell body either associated with the vessel or some distance away. From cell body extends numerous fine processes and one long. Long fibrous processes sometimes being in lose contact with blood vessels (Figs. 4, 5).

Figure 6. Radial glial cells extend from ventricular to pial surface x 150.

Some radial glial cells in *Scyliorhinus canicula* telencephalon extend from ventricular to pial surface (Fig. 6). Other lose their outher contact with the pia and retain endfeet at the ventricular surface. The somata of the radial glial cells are usually located near the ventricular surface, and their elongated processes traverse the entire width of the cerebral wall and may attach their endfeet on blood vessels (Fig. 7, 8) or give long, freely arborizing.

Some radial glial cells translocate their body at various depths of telencehalic wall and form characteristic astrocyte and acquire bushy astrocyte like appendages. One of appendages is long and remaining their endfeet at the pia membrane (Fig. 9, 10).

Figure 7. The soma of radial glia is located near the ventricular surface. x 180.

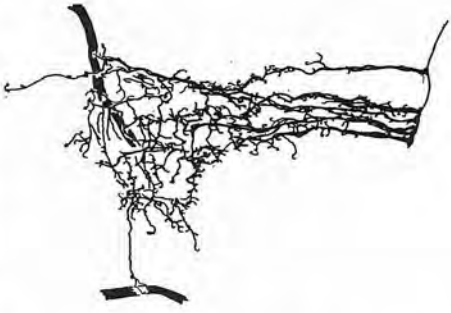

Figure 8. Golgi preparation of radial glia cells.

Figure 9. Radial glial cell et the depths of telencephalon. x 80.

Figure 10. Golgi preparation of radial glial cells.

DISCUSSION

Initial studies of several forms of submmamalian vertebrates (fishes, amphibians, and reptiles) led to the notion that the basic supporting framework of the nervous parenchyma in these species is provided by radial cells. These cells have been designated as ependymal or epithelial cells and the astrocytes sensu stricto were considered to be absent in these species. Although subsequent research demonstrated the presence of astroytes in these species (Kuhlembeck 1970).

Radial glial cells are the predominant glial cells in cyclostomes and teleosts (Ontentente et al. 1983) and are the earliest class of astrocytes to appear in all regions of the primate brain (Levitt *et al.* 1983). In submammalian species, radial glial cells persist throughout life, while in mammals, these cells transform into fibrillary astrocytes, protoplasmic astrocytes or (in the cerebellum) into Bergmann glial cells. The transformation of radial glial cells into astrocytes in mammals takes place over a relatively prolongated period (Schmechel & Rakić, 1979).

In *Scyliorhinus canicula* telencephalon the morphological differentiation of astrocytes we can see in adult brain.

The perivascular location of the dogfish glial and-feet in brain of the *Scyliorhinus canicula* suggests that they are arrived from protoplasmic astrocytes. Perivascular astrocytes constitute the morphological site of the blood-brain barrier in dogfish, *Scyliorhinus canicula* (Abbott et al. 1988; Zloković et al. 1988; Lazarević & Rogač, 1993; Lazarević & Rakić, 1995; Rogač et al. 1995).

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