TRIGEMINAL GANGLIUM – ELECTRONMICROSCOPY OF LARGE LIGHT PSEUDOUNIPOLAR NEURONS

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SUMMARY

Pseudounipolar neurons in trigeminal ganglion (TrG) were described citologically by Retzius(1880). Cells vary in size in rather wide diapason in the ganglion itself of the same individual, and in ganglia of different species as well. Size of the cells are from 10 to 110 µm and biggest pseudounipolar neurons were described by Buhler(1898) in human spinal ganglion with size of 120 µm.

Key words: trigeminal ganglion, pseudounipolar neurons.

INTRODUCTION

Electronmicroscopy investigations of (TrG) conducted by Koneff(1887, 1887) displayed two kinds of neurons in the ganglion, described by the author as: light-big and dark-small. Expeimental investigations on different kinds of animals were used by prominent histologists like Cajal, Nissl, Cox, Lugano and others for their classifications. Neurons are divided as large light neurons and dark-small (Dogiel, 1896; Cajal, 1909) and later named as type A and typa B – by Andres (1961).

Description of first sensitive neurons in (TrG) and brain trunk is discussed in works of Usunoff et al.(1997) and Marani and Usunoff(1998).

Goals and tasks

Goal of this presentation is investigation of ultrastructure of human (TrG).

Tasks, we intended to perform were using light-microscopic tool for investigation of human: trigeminal ganglion (TrG).

MATERIAL AND METODS

Investigations were conducted on human (TrG), samples of different ages of the species. Material was obtained from Department of Forensic Medicine and Deontology, and department of Pathology. The material was prepared by the standart method for electron microscopy.

Electron-microscopic investigations

This widely spread, contemporary method, allowed to obtain common idea concerning the condition of investigated tissue, due to the ultra structure of neurons. We used this method for demonstration . For this purpose we used human material (10 ganglia)

RESULTS

Electronmicroscopic investigation of trigeminal ganglion

On the base of materials taken from (TrG), we reached following conclusions.Fig.1

Via Electronmicroscopic investigation of the ganglion we could divide it onto three dfferent zones (nuclea), delicately separated from one another through fibers passing between them. Each of them contained heapings of pseudounipolar neurons, diffusely scattered and responsible for all three branches of nervus trigeminus.

Despite monotonous cell picture, observing carefully we could see cells, having different shapes of their bodies: round, ellipse, polygonal and elongated. Cell's body size can very in wide range. Apart from that, they can differ by specifics of their nouclea and citoplasma, and their correlation as well. In some of the nuclea could be observed dark colored small nuclea. Summarizing our results from observitions of (TrG) from rostral to caudal pole, we differentiate following types of neurons according to their shape and size of their pericarions:

Large light neurons
Middle light neurons
Middle dark neurons
Small light neurons
Small dark neurons
Neurons with elongated cell body
Neurons with polygonal shape

We will discuss only large light neurons (Fig.2)

These neurons can be observed in all cuts of (TrG). Diameter of pericarions is 25-45 µm and there are cases of more than 45 µm. They can be observed in all three nests of the ganglion, but more often can be observed in nests responsible for n. ophtalmicus and n. maxillaries, and they are located mainly in its periphery, but could be seen anywhere. These neurons possess huge body cell, which

is characteristic for pseudounipolar cells, and the ratio nucleus to citoplasma is 1: 1,8; 2.

Nucleus is positioned mainly in centre of the cell and is surrounded in periphery by a wide cytoplasmatic belt, rich of cell's organelles.

This picture determines light look of nucleus, which is the reason to name it hypohromic, characteristic for pseudounipolar neurons. The cytoplasma of larges light neurons is rich of cell's organelles, despite lightmicroscopic view as light, similar to hialin, giving the cell exceptionally transperent view. It was not established during our investigations any difference between big and light neurons in separate zones responsible for the three branches of neurus trigeminus. Cell's surface of this type of neurons is tightly surrounded by satellite cells with round shape.

Large light neurons with irregular cell shape (Fig.3)

Neurons with irregular cell shape, namely those with elongated and polygonal shape of pericarion are classified in separate group, according to their morphological feature – body shape. Neurons with this kind of body shape are observed rarely in neuropil of (TrG) unlike body cells of neurons typical for pseudounipolar cells. Following the object of our investigation, we came to the conclusion, that they can be observed more ofthen in the nests responsiible for ophthalmic and maxillar nerves.

There are some neurons, whose nuclea are positioned excentrically and are pushed to close contact with cytoplasma. Most frequently nuclea are oval or round, but there are cases when they immitate shape of the cell, means irregular shape, following the contour of its cell. Nuclear cytoplasmatic index of neurons is 1: 1.8. Small nuclea are with a spheric shape. Usually, small nucleus is in the center of the nucleus, but sometimes it could be found excentrically, near the cariolema. There are clearly visible Nissl' bodies, all of them dispersed in cytoplasma. In largest cells could be observed different quantity lipofuscine granulas, with nuance of pigmentation from light to dark brown color.

Lipofuscine pigments are accumulated most frequently in an end of the cell, but in some pericarions are positioned as a ring around the nucleus, in other cases is filling up almost the whole internal surface of the cell, giving it dark brown coloring. We established, that the biggest quantity of this pigment can be observed in corps samples, mainly in fertile period of their lives, and ratio men women was in favour of women.

DISCUSSION

Based on the classifications we used for the neurons in (TrG) from authors working on the problem i.e. Korner 1937, Andres 1961, Carmel and Stein 1969, Lieberman 1976 and Kai-Kai 1989. We established that not every one of them is full and thorough and because of that we created a classification combining the knowledge of above mentioned authors, which devides neurons according their size, shape and the presence of cytoplasmic organel.

Generally results of our investigation are in accordance with results of number of authors, working with different animal and human samples.

Trigeminal system is displayed by two populations of afferent neurons.

Essential difference of big light neurons is the protuberance of the trunk of the axons, concentrated in initial part or around whole surface of the cell, described by Cajal(1909); Stoyanova and Lazarov(2001, 2002).

Difference between big and small neurons in prenatal development is established in mammals and birds (Lawson et al., 1974; Gaik, 1973). Investigations, conducted throughout ontogenetic development prove earlier diferenciation of light neurons unlike that of dark neurons.

Based on cytoarchitectonic and ultrastructural observationsins in our investigation, we have come to a conclusion, that (TrG) is built of great variety of cell types, and that our knowledge of (TrG) as a compact and unifunctional structure is rather inaccurate and insufficient.

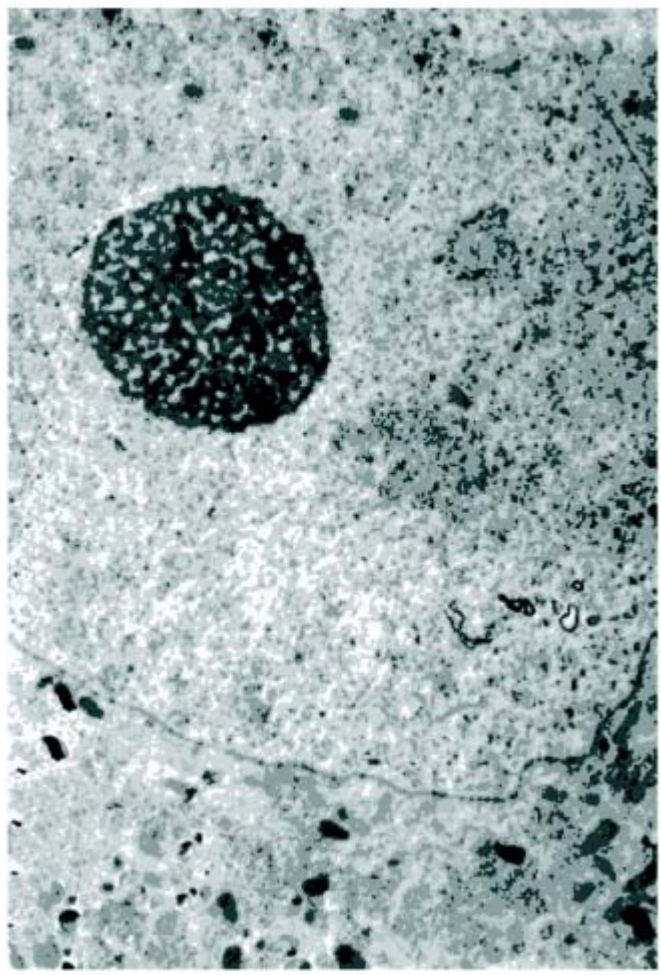

Fig. 1. Pseudounipolar neurons with large size localized in separate zones. x 12000.

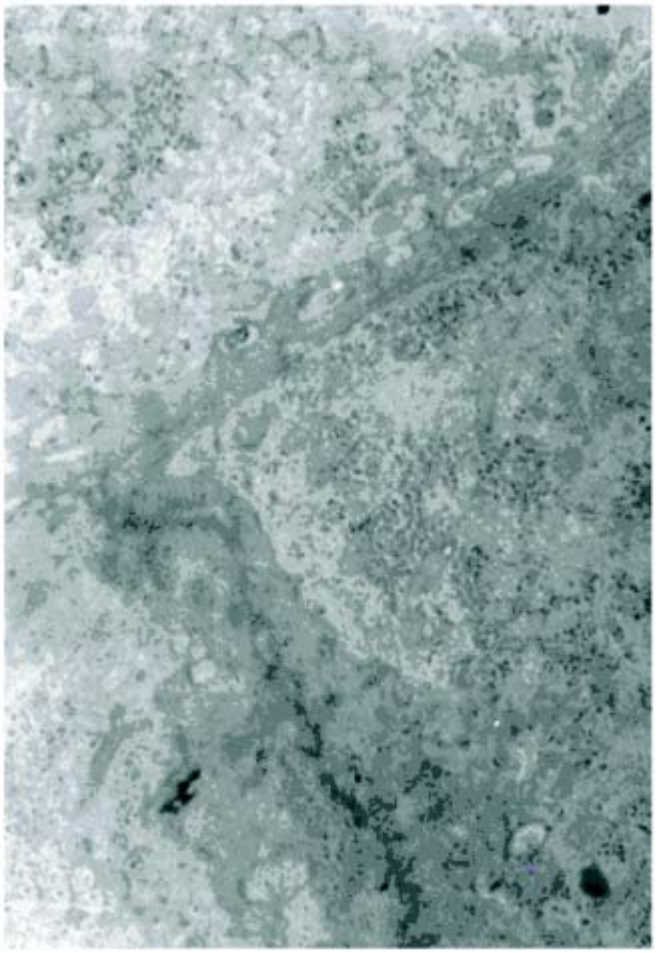

Fig. 2. There are seen neurons of a different size. Tightly stuck one to the other. Ìultiplied x 12000.

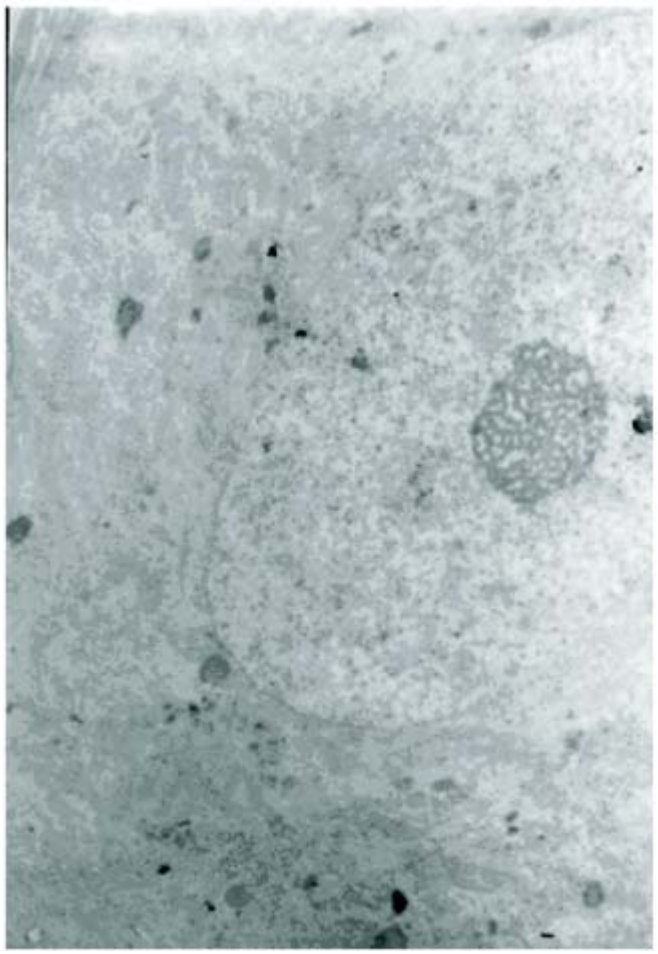

Fig. 3. At a medium magnification is seen a line of largest neurons surrounded by fibers. In some of them is seen an accumulation of a pigment. x 12000.

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