

GANGLION TRIGEMINALE – LARGE LIGHT PSEUDOUNIPOLAR NEURONS

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SUMMARY:

Pseudounipolar neurons in ganglion trigeminale (GT) 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: ganglion trigeminale, pseudounipolar neurons.

INTRODUCTION

Light-microscopic investigations of (GT) conducted by Koneff (1887, 1887) displayed two kinds of neurons in the ganglion, described by the author as: light-big and dark-small. Experimental 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 type B – by Andres (1961).

Description of first sensitive neurons in (GT) and brain trunk is discussed in works of Cajal (1907); Usunoff et al. (1997) and Marani and Usunoff (1998).

GOALS AND TASKS

Goal of this presentation is investigation of citoarchitratics and ultrastructure of human ganglion trigeminale (GT).

Tasks, we intended to perform were using light-microscopic tool for investigation of human ganglion trigeminale (GT) by Nissl method.

MATERIAL AND METHODS

Investigations were conducted on human (GT), samples of different ages of the species, as from 21 to 82 years. Material was obtained from Department of Forensic Medicine and Deontology, and department of Patoanatomy. Sample was prepared from (GT) and put into parafine. Later on were prepared cuts thick as 20 μm .

Light-microscopic investigations

For base of our light-microscopic investigations we used most widely spread method for coloring with

hematoxylin-eozin.

Coloring with hematoxylin-eozin

This widely spread in histological practice method, allowed to obtain common idea concerning the condition of investigated tissue, due to combination of coloring substances, related to two opposite groups.

Hematoxylin-coloring is a substance of plant origin, soluble in water and alcohol, posing basic characteristics and coloring organelles, having nuclein acids in the nucleus.

Eosin-sintetic color with acid characteristics is coloring in pink the citoplasma and is soluble in water and alcohol.

Coloring with azocarmin by method of **Haidenhain**

We used this method for demonstration of coloring samples. For this purpose we used human material (20 ganglia) and we prepared 100 samples.

RESULTS:

Light-microscopic investigation of ganglion trigeminale

On the base of materials taken from (GT), via horizontal cuts, colored by Nissl method, we reached following conclusions. Fig.1.

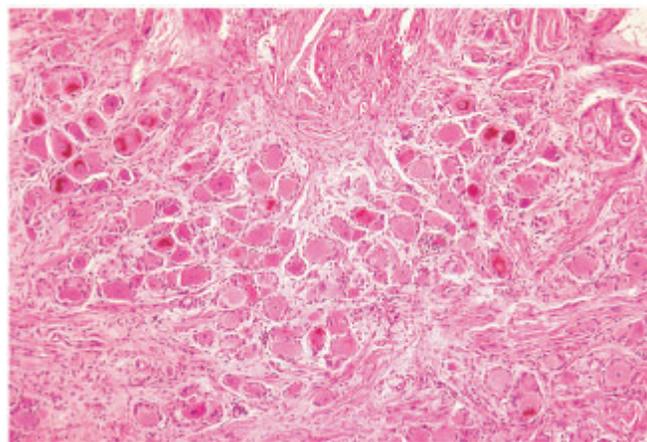


Fig. 1. Pseudounipolar neurons with different size localized in separate zones, and responsible for the three branches of the trigeminal nerve. H&E x 100.

Via light-microscopic investigation of the ganglion we could divide it into three different 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 vary in wide range. Apart from that, they can differ by specifics of their nuclea and cytoplasma, and their correlation as well. In some of the nuclea could be observed dark colored small nuclea. Summarizing our results from observations of GT from rostral to caudal pole, we differentiate following types of neurons according to their shape and size of their pericarions:

1. Large light neurons
2. Middle light neurons
3. Middle dark neurons
4. Small light neurons
5. Small dark neurons
6. Neurons with elongated cell body
7. Neurons with polygonal shape

We will discuss only large light neurons Fig. 2.

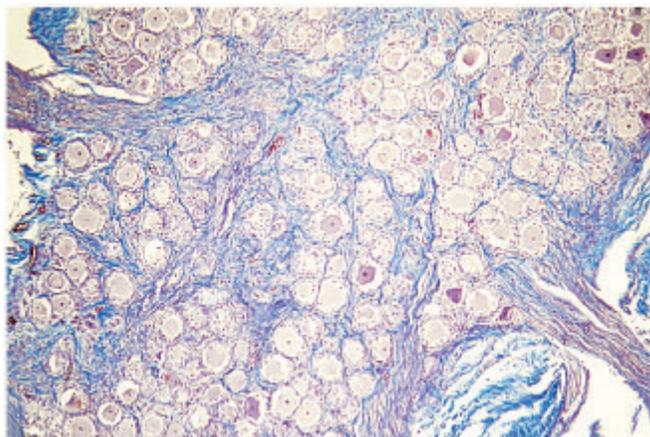


Fig. 2. There are seen neurons of a different size. Azan x 100.

These neurons can be observed in all cuts of (GT). 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 one can see them scattered singly along the ganglion's whole length. These neurons possess huge body cell, which is characteristic for pseudounipolar cells, and the ratio nucleus to cytoplasma is 1: 1,8; 2.

Nucleus is positioned mainly in centre of the cell and is surrounded in periphery by a wide cytoplasmic belt, rich of cell's organelles. One can observe chromatin along whole stretch of nuclear surface, finely dispersed in carioplasma. This picture determines light look of nucleus, which is the reason to name it hypochromic, characteristic for pseudounipolar neurons. Cytoplasma of large light neurons is rich of cell's organelles, despite light microscopic view as light, similar to hyalin, giving the cell exceptionally transparent view. It was not established during our investigations any difference between big and light neurons in separate zones responsible for the three branches of nervus 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.

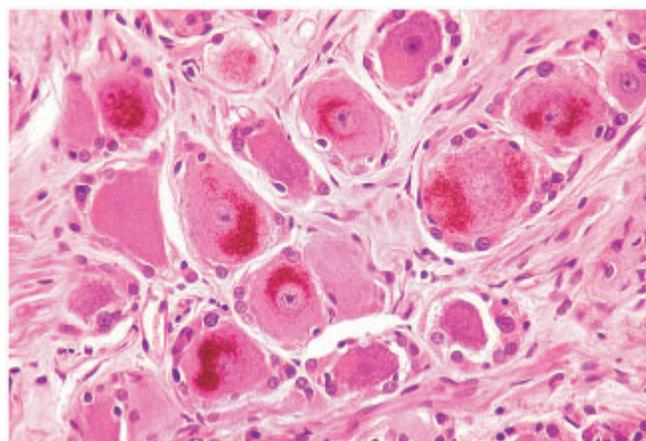


Fig. 3. At a medium magnification is seen a line of large neurons surrounded by fibers. In some of them is seen an accumulation of a pigment. H&E x 250.

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 GT 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 often in the nests responsible for ophthalmic and maxillary nerves.

There are some neurons, whose nuclei are positioned eccentrically and are pushed to close contact with cytoplasma. Most frequently nuclei are oval or round, but there are cases when they imitate shape of the cell, means irregular shape, following the contour of its cell. Nuclear cytoplasmic index of neurons is 1: 1.8. Small nuclei are with a spheric shape. Usually, small nucleus is in the center of the nucleus, but sometimes it could be found eccentrically, near the carioplasma. There are clearly visible

Nissl' bodies, all of them dispersed in cytoplasm. They look like roughly dispersed. 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. Coloring of the cell depends on the quantity of lipofuscine, it means the more granula and the thicker placed, the darker colored the cell is observed. Placement of pigments is observed very often in individuals of 21 to 82 years of age. We established, that the biggest quantity of this pigment can be observed in samples of corps samples, mainly in fertile period of their lives, and ratio men women was in favour of women. Fig. 3.

DISCUSSION

Display of citoarchitectonic picture of (GT) is directly dependent on methods in use. Despite multiple applications of Nissl' method (Panase, 1974; Stoyanova I, 2004; Wang H.,

Wei F., 2006), there are yet omissions in cytological aspect.

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 (GT) is built of great variety of cell types, and that our knowledge of (GT) as a compact and unifunctional structure is rather inaccurate and insufficient.

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