

SMALL NEURONS IN SENSORY GANGLIA

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SUMMARY:

Ganglion terminale (GT) in its essence displays gathering of pseudounipolar neurons, situated in impressio ganglion trigeminale of the pyramid. Peripheral tentacles of pseudounipolar cells take place in formation of first, second and third reception parts of the third branch of V cerebral nerve and central ones form receptive root entering into middle cerebellar peduncle.

Key words: receptive cells, small neurons, ganglia, pseudounipolar neurons.

INTRODUCTION

Ehrlich (1886) and Dogiel (1896), using methyl blue for coloring, and using silver impregnation methods like those of Golgi (1898) and Bielschowsky (1907) confirm pseudounipolar shape of receptive ganglia' neurons. Davies and Lumsden (1990) described development of (GT) in their publications. Pseudounipolar neurons of (GT) cytologically are described by Retzius (1880) as well. Cells in (GT) vary in size in rather wide diapason as in the ganglion of the same individual, so in the ganglion of different individuals. Cells' sizes are from 10 to 110 μ m. perykarions are with different shapes: predominantly round, but they could be observed such as with ellipse shape, for first time described by Hatai (1901), quoted by Bunge et al. (1967).

Most of neurons in (GT) described by Gasparsic R., è Kovacic U. (2006), which supply with innervation gingival mucosa are represented by small cells, containing calcitonin (CGRP) and substance P (SP). Investigations of calcitonin positive (CGRP) neurons, conducted by Ischikawa H. è Schulz.S. (2005) conclude, that there are small and middle size neurons, having along neurolema receptors DOR (Delta-opioid receptor), connected to anti pain function of receptive nervous system.

Galanin immunologic receptive cells in (GT) are few in number and are represented by small cells (Deguchi T.; Yabuuchi T.; Ando R.2006). Neurons, supplying with innervation mucosa of oral cavity, and those perykarions that are placed in (GT) are small to middle size and contain calcitonin (CGRP) and substance P (SP), described by Gasparsic R. and Kovacic U. (2006).

Goals and tasks

Goal of this presentation is to investigate human

cytoarchitectonic and ultra-structure of (GT) and presentation of small neurons using Nissl' method.

Goals to perform are:

Light microscopic investigation of human (GT) with Nills' method.

MATERIAL AND METHODS

Investigations were conducted with 20 couples of human (GT) presented by different age of wide range from 21 to 82 years of age. Human sample was supplied by Department of Forensic Medicine and Deontology and Department of Patoanatomy. Ganglion was placed in 4% neutral formalin and 7 days later advance dehydration with ascending alcohols, followed by lightning with cedar oil. Sample is placed in paraffin, followed by preparation of serial cuts with thickness of 20 μ m, colored by Nills' method.

RESULTS

We have drawn following conclusions based on material during our studies of peripheral ganglion of V cerebral nerve sliced horizontally and colored by Nills' method.

Using light microscope for observing surface of the ganglion, we could divide it on three separate zones (nuclei), delicately separated from each other via fibers passing between them. Each of these zones composed of piling of pseudounipolar neurons scattered diffusely scattered and responsible for three branches of nerve trigeminus.

Observing samples, colored by Nills' method in slight magnification each of the nests could be separated into two parts - dorsomedial and ventrolateral. Cells, positioned in dorsomedial part are more tightly packed in comparison with cells in ventrolateral part, and are visibly smaller. These cells, positioned ventrolaterally are with bigger perykarions and they have greater distance between them. This is the place where ramification of the three branches of V cervical nerve (ophthalmicus, maxillaris è mandibularis) occurs.

Despite monotonous cell picture, they are displayed in greater percent (over 80%) by small and middle size pseudounipolar cells. Observing more carefully there are cells with variety of forms (round, ellipse, polygonal and elongated) which could be seen. Size of cell's body varies as well widely. They differ in characteristics of their nuclei and cytoplasm, and their correlation as well. In some of the cells' nuclei are observed dark colored small nuclei. Summarizing

results of our observations of samples from horizontal cuts of (GT) of rostral and caudal poles, we differentiate following types of neurons according their shape and size of their perykarions: Fig. 1.

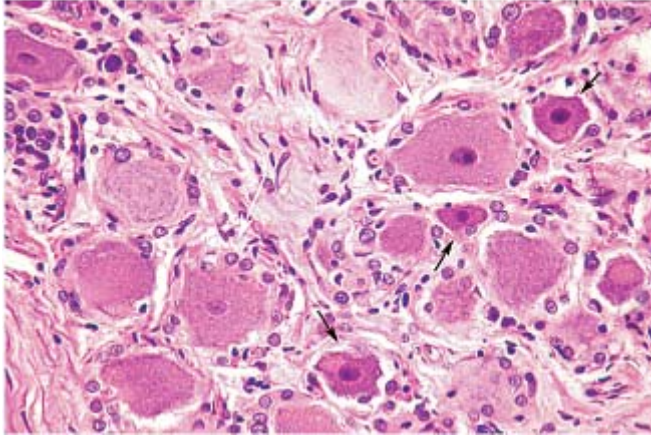


Fig. 1. Small pseudounipolar neurones with different size in ganglion trigeminal. H E x 250.

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

Ultrastructure of ganglia trigeminale

Based on results of our investigations with samples colored by Nills' method, we tried to classify neural population according size of neural perykarion and according to pigmentation (due to granula endoplasm reticulum). In respect to this subdivision of neurons positioned in (GT) each group of small neurons can be described separately (Fig. 2.).

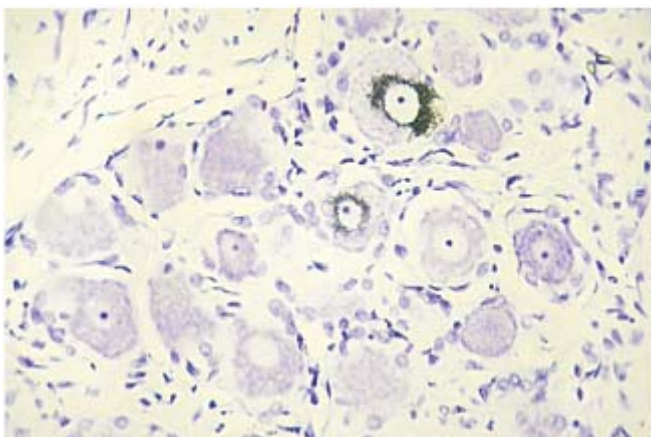


Fig. 2. There are seen small neurons of a different size. Azan x 250.

Small light neurons

They are smallest neurons in the structure of (GT). Their size is 10 - to 13 microns, and they have scarce cytoplasm (compared with other groups of neurons), and great number of cell' organelles. They can be observed in all parts of (GT), distributed rather uniformly. Based on the contour of body cell and to certain extent to distribution of the cells' organelles, these neurons can be separated I two subgroups.

1. First subgroup of small neurons is typically pseudounipolar, means they have round or ovoid body shape. Their nuclei are with slight ovoid or oval shape. There are neurons, whose nucleolus is compressive (comparable with the shape and size of large neurons), but in most cases they are small and correspond to size of small neurons. Usually they are situated eccentrically. In some cases could be observed two nucleoluses.

Cytoplasm forms dark and big cloud wrapping as a ring the nucleus. Most commonly it is with considerably darker color (compared with big neurons), due to presence gathered by great number of organelles. In this kind of neurons number of cells' organelles is always represented in great deal.

Presence of great number of cells' organelles is a sign of vigorous cell activity.

2. Second subgroup of small and light neurons has ovoid elongated or irregular contours of body cell. Due to their higher electronic thickness compared to the above mentioned (described in the above subgroup), they can be characterized as thick neurons, as if big part of the liquid contains in cytoplasm is derived during applied method of preparation. In this way they look like a bit squashed and not very active, as though they are in stage of degeneration. These types of neurons are not observed often, but due to their specific characteristics are very easily identified.

Their nucleus is relatively big, and their membrane makes wavelike motion and at times makes invaginations with different depth and branches.

Small dark neurons

Greater part of these groups of neurons have size like 12 -15 micrometers. They could be met if all three parts of (GT) with equal frequency, but in the area of (GT), responsible for separating of mandibular nerve, there are small groups of 2 – 5 neurons. Ratio nucleus/cytoplasm is from 1:1,4 to 1,2. these cells have wider diapason in the shape of perykaria. This is one of the reasons, which in the past they were considered as artifacts, sequence of bad preparation of the sample or a cell in degeneration state. Their shape is round, elliptic, fusiform, and with irregular contour of perykaria. Using these criteria we could divide them into two subtypes.

1. Cells with characteristic shape of pseudounipolar neurons

2. Cells with irregular shapes

Small nucleus is single and most often placed in the

centre, it looks like shabby, sometimes it could be noticed large zone of greater thickness, compared of that of nuclear interstitium.

We could observe in some neurons heaps of lipofuscin granolas giving light on the background of considerably dark and thick cytoplasm. In other neurons they are almost equally dispersed around the cytoplasm.

Distinguishing neuronal types is not always an easy task. Sometimes definition of certain type neurons could be done from the first sight of sample of (GT), especially

concerning small cells, containing big pigment quantity in their cytoplasm. They are best appearing positively in samples colored by Nills method.

DISCUSSION

Discovering cytoarhitectonic picture of (GT) is in direct dependence from used methods. Despite multiple investigations with Nills' method (Panase, 1974; Stoyanova I.,2004; Wang H., Wei F., 2006), there are still some omissions in cytological aspect.

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