Journal of IMAB - *Annual Proceeding (Scientific Papers)* 2007, vol. 13, book 1

SATELLITE CELLS OF TRIGEMINAL GANGLION

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SUMMARY

Trigeminal ganglion is composed of ganglion cells (pseudounipolar neuron), satellite cells and their fibers. Altman and Bayer (1982) tend to see the origin of these cells in the trigeminal ganglion, emphasizing on the fact that they are part of the neuronal ridge/arch. Davis and Lumsden(1990) in their publications describe development of the trigeminal ganglion, confirming their standpoint concerning the origin from neuronal ridge/ arch and ectodermic placoids. This standpoint was confirmed by Rhoades (1991).

Key words: Trigeminal ganglion, satellite cells, neurons.

INTRODUCTION

It is clearly visible on histological samples that perikarya of pseudounipolar neurons are tightly wrapped by small satellite cells with intimately connected neurolemmas. Satellite cells were named by Cajal (1899) and described as cells with flat shapes. According to Kerr research (1967) initial glomerular part of the human axon is not covered by myelin for the first 100 micrometers of glomerular apparatus, and is covered only by satellite cells.

Description of first receptive neurons and surrounding satellite cells in trigeminal ganglion is maintained in the works of Cajal (1907); Usunoff at al. (1997) and Marani and Usunoff (1998).

Cajal (1899) describes cell population of neurons and tightly situated small cells, named satellites. Their shapes are polimorphal: polygonal, star-like and round-like with short tentacles. They display functional similarity with Schwann cells in the peripheral neuronal system. There is opinion of Yntema (1937) and Weston (1970) that their origin is most probably identical with that of Schwann cells and all of them originate from neuronal ridge/arch. Pannese (1960) conducted a research with rats and calculated the surface of the perikarya of one satellite cell, it was approximately 400 mm2. Position of satellite cells in some parts is very tight, and in other pars is about of 20nm. It is established, that between some of them are formed contacts of “gap junction” type, Pannase (1969), adhesion connections and presence of desmosomes. Outer surface of satellite cells is smooth and covering basal membrane with 20-30 nm thick, separating satellite complex from endoneurinum. Lieberman (1965) describes the presence of two satellite cells, situated one next to the other with no basal membrane between them. Beaver et al., (1965) described lack of basal membrane in some parts of tight contact of two satellite cells. Morphological characteristics of inner organelles of satellite cells is expressed by their gathering in perinuclear zone, and close to surface of the neurolemma there are only skeleton shaping microtubules and microfilaments and rarely presence of mitochondria.

Hystochemical investigations confirm presence of peroxisomas in satellite cells, and this gives us grounds for presumption of their active participation in destruction of some material, as well transformation of amino-acid transmitters, Citcowitz and Holtzman (1973).

Research conducted to this moment concerning trigeminal ganglion on light microscopic, electron microscopic and on experimental level of whole structure of human ganglion trigeminal, to certain extend confirms data of preceding investigators, who worked in the past with animals. Contemporary research on the base of modern technologies considerably add, and in some cases shed a new light on detailed learning of morphological ganglion structure, and its physiological importance, role, connections and communications with periphery.

GOALS AND TASKS

Goal of this research is to investigate cytoarchitectonics and ultra-structure of human ganglion trigeminal with Nisll method.

To demonstrate interdependence and perikarya of pseudounipolar neuron and satellite cell.

Tasks for performance are:

Light microscopic investigation of human trigeminal ganglion with Nisll method.

Coloring with haematoxillin-eozin.

Coloring with azocarmin by Haidenhain. (Azan)

Materials and methods

Investigations were conducted with 20 pairs of human ganglion trigeminal, all of them of different age, in wide diapason from 21 to 82. Samples used were received from Department of Forensic medicine and deontology and Department of Pathology.

At the beginning the ganglion is put in 4% neutral formalin, and 7 days later is undertaken a procedure of dehidratation in increasing alcohols, following lightening in cedar oil. Then the sample was put in paraffin, and after that series of cuts of 20 mm thickness were prepared.

RESULTS

All along ganglion trigeminal, in its three spots responsible for the 3 branches of the fifth nerve, around perikarya of pseudounipolar neurons are positioned small satellite cell. Their number is different and usually depends on the size of the neuronal cell. For example the big neurons, satellites tightly surround the perikarya, positioned in close contact with each other, as a ring around the cell.

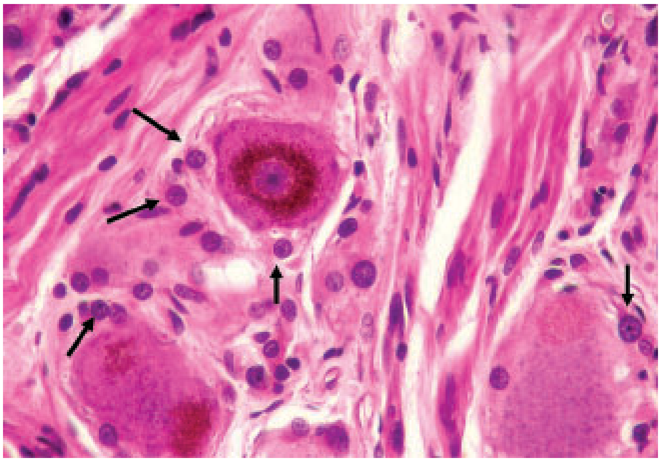

Fig. 1. Satellite cells with different size disposed around the perikarya of pseudounipolar neurones in ganglion trigeminal. H E x 400.

According to Spasova et al. (1978), after traumatic or experimental damage of the peripheral nerve, apart from changes coinciding perikarya of pseudounipolar neurons, it can be observed changes in satellite cells as well. This event is most demonstratively displayed in their contacts, namely in increasing their numbers due to necessity of greater steadiness. With middle and small size neurons the situation is different - they usually are positioned on certain distances and the ring they form looks like loose, or not completed. During our investigations we observed big neurons, situated at the beginning of first and second branch of the fifth nerve, and placed amongst nerve fibers. Around these neurons satellite cells are very few and scattered on great distance from each other.

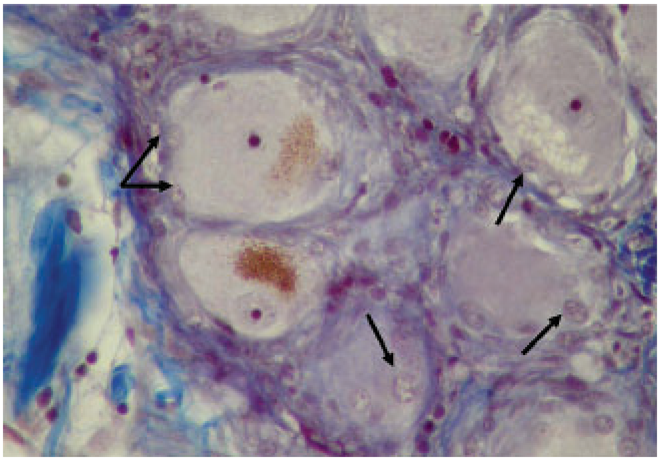

Fig. 2. Satellite cells around the perikarya of large neurons. Azan x 400.

Cajal (1899) describes the shape of these cells as polymorph: flat, elongated, ovoid, polygonal and placed tightly close to each other. They display similarity with Schwans cells in peripheral nervous system. All cellular organelles are present in their cytoplasm, but in poor quantity. There were present some glycogen granulas, scattered around the nucleus in some of satellite cells.

The nucleus is placed a bit eccentric, with a light circle around it. In some of the satellites are observed two nucleuses placed together. There are nucleuses with round shape, but with elliptic as well. Cariolemma is smooth, and only in few satellites can be observed small invaginations. Chromatin is uniformly scattered and gives to nucleus a homogeny appearance. The small nucleus is dense, well visible and eccentrically placed.

DISCUSSION

Discovering of cytoarchitectonic picture of trigeminal ganglion is in direct dependence on methods applied. Despite of many investigations with Nissl method (Panase, 1963; Stoianova I., 2004; Wang H., Wei F., 2006), methods rarely used for pseudo-uni-polar neurons, and those used with the rest of brain structures – Golgi (Cayal, 1928; Morest, 1964; Spasova, 1987; Malmierca et al., 1993; Stoyanova, 2005) there are still omissions in cytological aspect.

Generally speaking results of our investigation are in accord with results of many authors, working with different kinds of animals, and human samples as well.

Results of our research are related to light microscopic purpose.

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