DOI 10.26724 / 2079-8334-2018-2-64-173-175
UDC 611.835.8-071.3:616-002-021.4] – 092.9

R.V. Svyrydiuk, K.V. Shepitko, V.I. Shepitko, T.Я. Раскалей
HSEE of Ukraine "Ukrainian Medical Stomatological Academy", Poltava.

MORPHOMETRIC CHARACTERISTICS OF THE SCIATIC NERVE TRUNK IN THE ACUTE ASEPTIC INFLAMMATION IN RATS

E-mail: Shepitko1973@ukr.net

The total of 55 mature male rats were involved into study. The dynamics of changes in morphometric parameters in single intraperitoneal administration of 5 mg λ- carrageenan (Sigma-USA) in 1ml saline per one animal, inducing changes in the investigated morphometric indices, has been shown. Thus, the indices of the common wall, epineurium, perineurium and endoneurium of the rat sciatic nerve trunk responded to the increase of the parameter maximally on day 14 – 21 of the experiment and did not reach the indices of the intact group on day 30, indicating the manifestations of dystrophic processes with atrophy in the trunk of the sciatic nerve.

Keywords: trunk, sciatic nerve, λ- carrageenan, aseptic inflammation.

The paper is a fragment of the research project "Experimental-morpholdical study of the effect of cryopreserved placenta transplants onto morphofunctional state of the viscera" State registration number: 1008U001572,the author is a contributor to the present paper.

Chronic inflammation in combination with disorders of the metabolic process of different severity and neurological symptomatology of varying etiology is the most typical clinical manifestation of sciatica [1,9]. One of the major pathophysiological factors for sciatica is chronic intoxication of viral origin, generalized infection (purulent inflammations), metabolic disorders, consumption of dietary supplements, preservatives, frequent hypothermia [2, 3, 4]. Therefore, the clinical symptomatology of various chronic diseases of peripheral nervous system has much in common with the diseases of the sciatic nerve trunk and leads to errors in establishing of the correct diagnosis, and follow-up outcomes in sciatica [5,6]. Pathomorphological presentation of the inflammatory process in the sciatic nerve is characterized by the signs of inflammation and dystrophic changes in the nerve fibers with its subsequent atrophy. Pathological processes can extend to the entire area of the sciatic nerve trunk, and sometimes can be local [1,2,3]. Since the inflammation of sciatic nerve trunk often occurs in individuals of the working age, and in severe cases, the disease leads to complete disability, requiring certain material costs of its treatment both for a patient and the state, indicating the socio-economic importance of this problem not only in Ukraine, but worldwide, too [1,7,8]. Consequently, the study of morphological manifestations of aseptic inflammation of the sciatic nerve trunk in Wistar albino rats is the topical issue of contemporary experimental medicine. Study of the morphometric manifestations of the disease and extension of the lesions can be the key for the correct diagnosis and follow-up treatment management of inflammatory processes not only in the trunk of the sciatic nerve, but in the treatment and diagnosis of the entire peripheral nervous system.

The purpose of the paper was to establish the changes in morphometric parameters of the rat sciatic nerve in the acute aseptic inflammation.

Materials and methods. The trunk of the sciatic nerve, extracted from the 55 mature male Wistar albino rats has been studied. The experiment has been carried out in compliance with the "General Ethic Rules for Conducting Experiments on Animals" (2006, Annex 4) and Declaration of Helsinki on ethical principles for medical research involving animals. The animals were assigned into two groups: Group I (n=10; the controls); Group II (n=45), subjected to administration of intraperitoneal 5 mg λ-carrageenan (Sigma - USA) in 1ml saline per one animal to induce the generalized acute aseptic inflammation. The animals were killed under thiopental anesthesia overdose in compliance with the scheduled periods (1, 2, 3, 5, 7, 10, 14, 21, 30 day of the experiment). The fragment of the sciatic nerve was taken out more distally of the middle third of the sciatic nerve for the light optic study according to the conventional technique [1]. The collected material was fixed by perfusion in 10% formaldehyde solution in 0.1 phosphate buffer with subsequent defixation in buffered formaldehyde. The frozen 15 μm thick sections were made in the MK-25cryotome. Subsequently, the sections were impregnated with silver nitrate by the fast modification method [2]. The count was made using the microscope with Olympus C 3040-ADU digital microphotohead with Olympus DP - Soft software, adapted for the studies (License No. VJ285302, VT310403, 1AV4U13B26802) and BIOREX 3 (serial number 5604). Mathematical processing of the material has been carried out using the distribution-free standard methods

of variation statistics: calculation of mean values (M), error of mean (m), Student's T-test (t). Differences were considered to be reliable, when $p < 0.05$.

Results of the study and their discussion. The trunk of the rat sciatic nerve is surrounded by three layers: connective tissue layer (epineurium), which surrounds the trunk of the sciatic nerve with lengthwise (collagen, elastic) fibers that serve as the membranes (perineurium), and connective tissue layer, which surrounds the fascicles of the medullated fibers (endoneurium) (Figure 1).

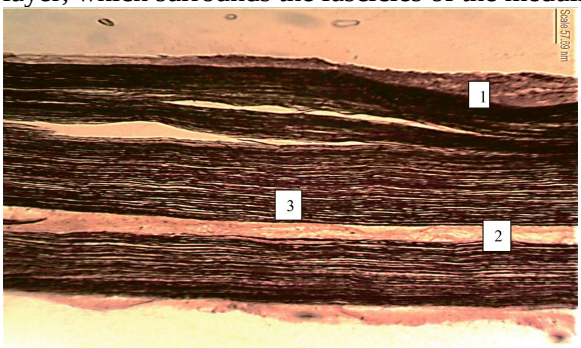

Fig. 1. The trunk of the rat sciatic nerve. Silver nitrate impregnation. Magnification: ocular lens ×10, lens ×10: 1 – epineurium, 2 – perineurium, 3 – endoneurium.

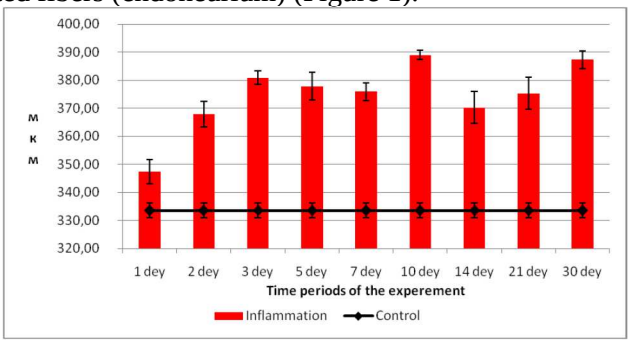

Fig. 2. The total thickness of the trunk of the sciatic nerve in the acute aseptic inflammation.

The analysis of the morphometric indices of the thickness of the sciatic nerve trunk has shown that they changed dynamically and differently in animals of Group II. The findings of the analysis are presented in Figure 2. The comparison of indices between the groups has found the growing of the total thickness of the wall of the sciatic nerve trunk within days 1-30 of the experiment. Starting from day 1, a significant increase of this parameter with the highest score on the day 10 was recorded. On day 21 of the experiment a significant reduction of the total thickness compared with the similar index of the intact group was found. On day 30 a significant growth of the total thickness of the sciatic nerve trunk was detected.

The comparison of the indices between the time periods of the experiment has shown a significant rise on day 1 with significant increase on day 2 and 3 of the experiment. The comparison between the indices has established the lowering of the index starting from day 3 to day 7, though no significant difference between them was found. On day 10 the index significantly raised as compared with day 7 of the experiment. On day 14 the significant rise of the same index was observed as compared with day 10 and no significant increase was detected up to day 30. The statistical analysis of the thickness of epineurium between the groups during the experiment has shown the following changes. The findings of the analysis are shown in Figure 3. The thickness of epineurium was growing within day 1-30 as compared with the similar index in the intact group; the reliability of difference was significant ($p<0,05$).

The comparison of the indices between the time periods of the experiment has shown the following changes. Starting from the day 7 to day 30 of the experiment no significant difference between the time periods of the experiment was found ($p>0,05$). The study of the mean index of the thickness of perineurium has established that they changed differently between the study groups during the experiment. The significant rise of the index from day 1 with the peak values on day 14 of the experiment was found. From day 21 to 30 this index was higher than the values in controls and was at the level of day 7 of the experiment.

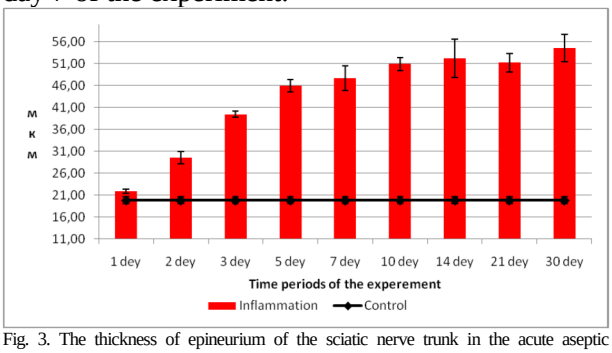

Fig. 3. The thickness of epineurium of the sciatic nerve trunk in the acute aseptic inflammation.

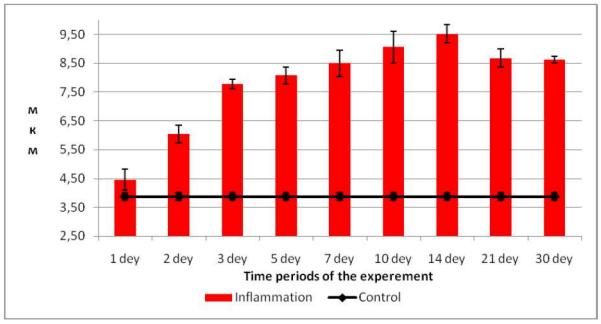

Fig. 4. Thickness of perineurium in the acute aseptic inflammation.

The morphometric analysis of perineurium thickness (findings of statistical analysis are presented in Figure 4) has revealed a significant increase of this parameter between the time periods of the experiment starting from day 1 to day 3. The analysis of the parameter between the time periods of the experiment showed its insignificant increase from day 3 to day 30 ($p<0,05$). The statistical analysis of endoneurium between the groups has shown that from day 1 to day 3 the index of its thickness was

increasing with the peak value on day 30. The increase was significant only in comparison with day1-2 in $p<0,05$. On day 5 and 10 the index was tending to decrease between the groups; however, the reliability of differences between the groups was not high. The analysis of indices between the time periods of the study has shown a significant difference only on day 1-3 of the experiment. The comparison of indices between the time periods of the study from day 3 to 30 showed no significant difference between them.

Conclusion

To sum it up, the acute aseptic inflammation of the sciatic nerve trunk, induced by the single intraperitoneal administration of λ- carrageenan, led to general changes in the sciatic nerve trunk maximally on day 14-21, triggering the pathomorphological mechanisms of the acute inflammation in the form of dystrophic changes in the mucous membrane with subsequent atrophy of all sections of the sciatic nerve trunk.

The prospects for further research will encompass the study of the dynamics of morphological and metric changes in sciatic nerve trunk in normal condition and in single administration of cryopreserved placenta.

References

1. Herashchenko S. Peryferiynyy nerv: neyro-sudynno-desmalni vzayemovidnoshennya v normi ta pry patolohiyi. Ternopil: Ukrmedknyha; 2009. 382 s. [in Ukrainian]
2. Kolomiytsev A, Chaykovskiy Yu. Bystryy metod impregnatsii serebrom elementov perifericheskoy nervnoy sistemy prigodnyi dlya tselloidinovykh i parafinovykh srezov Arkhivy anatomii, gistologii i embriologii. 1981: 93-96 [in Russian]
3. Skotarenko TA, Shepitko KV. Reaktsiya kirkovoyi rechovyny nadnyrnykiv pry hostromu aseptychnomu perytoniti ta yoho korektsiyi vvedennyam kriokonservovanoyi platsenty. Svit medytsyny ta biolohiyi. 2016; 1 (55): 156-159. [in Ukrainian]
4. Yakushko OS, Shepitko KV. Morfolohichni osoblyvosti perebihu hostroho eksperymentalnoho nevrytu zorovoho nerva shchuriv. Svit medytsyny ta biolohiyi. 2009; 4: 75–78. [in Ukrainian]
5. Rinkel W.D. Huisstede M.A., VanderAvoort D.-J. J.C., Coert J. H., Hovius S. E. What is evidence based in the reconstruction of digital nerves? A systematic review. Journal of Plastic, Reconstructive & Aesthetic Surgery. 2013; 66: 151- 164.
6. Semionow M., Brzezicki G. Current techniques and concept sin peripheral nerve repair. International reviewofneuro biology. 2009; 87 : 141-172.
7. Sarikcioglu L., Demirel B., Utuk A., Walking track analysis: anassessment method for functional recovery after sciatic nerve injury in therat. FoliaMorphol. 2009; 68: 1-7.
8. Stoll G., Joster S., Myers R.. Degeneration and regeneration of the peripheral nervous system: From Augustus Waller's observation stone uroinflammation . Journal o f the Peripheral Nervous System. 2002; 7:13-27.
9. Ubogu E. Translational strategies in peripheral neuroinflammation and neurovascular repair. Transl. Neurosci. 2012; l 4. (3): 373-383.

Реферати

МОРФОМЕТРИЧНА ХАРАКТЕРИСТИКА СТОВБУРА СІДНИЧНОГО НЕРВА ПРИ ГОСТРОМУ АСЕПТИЧНОМУ ЗАПАЛЕННІ У ЩУРІВ.

Свиридюк Р.В., Шепітько К.В., Шепітько В.І., Раскалєй Т.Я.

Дослідження проведено на 55 статевозрілих щурах самцях. Показана динаміка змін морфометричних параметрів при одноразовому внутрішньочеревинне введення 5мг λ-карагенена (Sigma - США) на 1мл фізіологічного розчину викликає зміни досліджених морфометричних показників. Так, показники загальної **с**тінки, епіневрію, периневрію та ендоневрію стовбура сідничного нерва щурів реагували збільшення показника максимально на 14-у – 21-у доби експерименту і не досягши показників інтактних груп на 30-у добу, що вказує на прояви дистрофічних процесів з атрофією стовбура сідничного нерву.

Ключові слова: стовбур, сідничний нерв, λ-карагенен, асептичне запалення.

Стаття надійшла

МОРФОМЕТРИЧЕСКАЯ ХАРАКТЕРИСТИКА СТВОЛА СЕДАЛЕЩНОГО НЕРВА ПРИ ОСТРОМ АСЕПТИЧЕСКОМ ВОСПАЛЕНИИ У КРЫС.

Свырыдюк Р.В., Шепитько К.В., Шепитько В.И., Раскалей Т.Я

Исследование проведено на 55 половозрелых крысах самцах. Показана динамика изменений морфометрических параметров при однократном внутрибрюшинном введение 5 мг λ-карагенена (Sigma - США) на 1 мл физиологического раствора которое вызывает изменения исследованных морфометрических показателей. Так, показатели общей стенки, епинервия, перинервия и ендонервия ствола седалищного нерва крыс реагировали увеличение показателя максимально на 14 – 21 сутки эксперимента и не достигнул показателей интактной групп на тридцатый день, что указывает на проявления дистрофических процессов с атрофией в стволе седалищного нерва.

Ключевые слова: ствол, седалищный нерв, λ-карагенен, асептическое воспаление.

Рецензент: