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SOLEUS MUSCLE TROPHISM OF WISTAR RATS AFTER NERVE COMPRESSION AND ELECTROSTIMULATION

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SUMMARY

The aim of this study was to evaluate the use of high voltage current on the tropism of soleus of rats with sciatic nerve compression. 18 Wistar rats divided into: GS: nerve compression and simulacrum; GP+: compression and treated with anodic current; GP-: compression and cathode current, were used. At the end, the soleus were dissected and weighed on an analytical balance. Then slides were mounted transverse cuts observed in ordinary light microscope and digitized for analysis of smaller diameter of 100 fibers per muscle. All groups showed lower tropism, in both forms of evaluation, and comparison among groups did not differ. It is concluded that the high voltage current did not inhibit hypertrophy in soleus underwent nerve compression.

INTRODUCTION

Injuries to the peripheral nerve tissue can occur due to trauma or compression, leading to changes related to nerve conduction, producing symptoms such: tingling, pain, decreased strength, and in extreme cases: anesthesia and the motor activity absence [1,2].

One form of electric current used in therapy is the high voltage current. Characterized by being pulsed, single-phase, double-peak, with a pulse duration ranging from 5 to 100 μ s, with high peak amplitude and high voltage. It is a current with nice pacing, being able to depolarize sensory, motor and nociceptive nerve fibers [3].

To evaluate the efficacy of therapeutic modalities, experimental models of sciatic nerve compression in rats have been used, due to its similarity to the human sciatic nerve [4]. The objective of this study was to evaluate the use of high voltage current on the cross-sectional area of soleus muscles of rats subjected to compression of the sciatic nerve.

METHODS

We used 18 male Wistar rats, with 14 ± 2 weeks of age. The study was approved by the Unioeste Ethics Committee on Animal Use (0209). The animals were grouped and maintained in polypropylene cages, under controlled environmental conditions, with light / dark cycle of 12 hours, temperature 23 ± 1 °C, with access to water and food ad libitum. Randomly divided into 3 groups:

- GS (n = 6) – submitted to compression of the sciatic nerve in the right hind limb, and the placebo treatment (sham);
- GP + (n = 6) – compression and treated with anodic current at the surgical site;
- GP - (n = 6) – compression and treated with cathodic current.

The animals were anesthetized with xylazine (12 mg/kg) and ketamine (95 mg/kg) intraperitoneally. The sciatic nerve was exposed through an incision parallel to the femoral biceps muscle fibers of the right thigh. Later there was a compression of the nerve into four distinct regions along its length with approximate distance of 1 mm from one to another with wired chrome catgut 4.0, reproducing the symptoms of a sciatica [5].

On the 3rd day after compression was initiated daily treatment for 10 days, with sessions of 20 minutes each, using equipment from high voltage Neurodyn High Volt (IBRAMED®, Brazil). The electrodes used were silicone-rubber, and positioned on the region of the surgical incision and lumbar region of the animals. The active electrode (site of surgery) was 1 cm² and the passive electrode (lumbar region) was 4 cm². The current intensity used in volts peak was increased to observe muscle contraction then reduced in 10% of this value.

At the end of the treatment period, all animals were sacrificed by decapitation. Soon after, the right and left soleus muscles were isolated, cleaned, weighed on an analytical balance (Shimadzu®), and then fixed in 10% formalin. In sequence, the biological material followed the steps of routine histologic processing. Transverse sections were made in Olympus® microtome, thickness of 7 μ m, and stained with hematoxylin and eosin. The microscopic fields of interest were scanned using an optical microscope common (Olympus®), digital camera (DCE-s) attached and 40x objective lens. The captured images were analyzed using Image-Pro® Plus 3.0, about the smaller diameter 100 fibers per muscle [6].

Data were evaluated by comparing the results obtained in the left soleus muscle, which represents the control side, and right, between animals of the same experimental group using the Student *t* test, and comparison between groups was performed using ANOVA one-way, and considered

significant $p < 0.05$.

RESULTS AND DISCUSSION

It was observed that all groups showed lower muscle mass on the right side, where there was compression of the sciatic nerve. For the evaluation of smaller diameter on the side that was compression, was also significantly lower (Table. 1). But there was no significant difference between the groups when comparing to the right or left sides.

Compressions that induce local ischemia in peripheral nerves, can generate electrophysiological changes in nerve conduction [7], and eventually leading to muscle weakness [2,8-10]. Because peripheral nerve injuries induce inactivation and subsequent lack of load on the affected skeletal muscles is a trend to progressive muscular atrophy, with marked loss of muscle mass and reduced cross-sectional area of muscle fibers [11]. Furthermore, the sciatic nerve compression causes muscular pain that produces inhibition, which in turn aggravates atrophy by a lack of usage [12]. It is assumed in this study that the use of current analgesic, might interfere with pain, facilitating the free movement of the animal and thus could occur less muscle hypotrophy than that observed for the control group, which did not proved, both by the lower mass observed on the side of nerve compression, as the smaller diameter of the muscle fibers.

Also, several experimental studies have shown favorable results of electrical stimulation to nerve recovery, enhancing the regeneration of sensory and motor neurons, with myelinated fibers increased. Thus, it was expected that the current would have a protective effect on the hypotrophy to be installed by decreased nerve conduction [13], ie by improved conductivity nervous, but as already mentioned, this hypothesis was rejected, since the behavior of the control group was similar to the treaties.

CONCLUSIONS

The use of high voltage current was not effective in inhibiting the hypertrophy in soleus of rats with sciatic nerve compression.

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Table 1: Results presentation of the soleus muscle mass (g) and cross section of 100 fibers per muscle on the right and left in different groups.

	GS		GP+		GP-	
	Left	Right	Left	Right	Left	Right
Muscle mass (g)	0,153±0,014	0,075±0,004*	0,154±0,009	0,083±0,007*	0,151±0,005	0,080±0,007*
Cross-sectional area	27,74±3,79	18,38±2,01	28,55±2,03	20,99±2,03	27,33±1,33	19,63±2,32

* significant difference when comparing with the left side.

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