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Modernized Electrodes for Transcranial Electrical Stimulation of Animals.

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ABSTRACT

The article is concerned with modernization of electrodes for the transcranial electrical stimulation of animals, which consists of electroconductive rounded plates and fastener with clasp. The medical electrodes were used as prototype.

Keywords: transcranial electrical stimulation, Transair-2 device, beta-endorphin, electrodes.

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INTRODUCTION

In recent years the transcranial electrical stimulation is widely used in the veterinary practice as the correction of adaptive processes and preventive measures of animal stress during transport, which received the patent of the Russian Federation No. 2477154 [1].

The devices consist of the electrodes made in the form of metal plates or electroconductive fabric, which are fixed on the human head by special device made in the form of textile tape or metal frame [2] and such devices are known in the medical practice. The disadvantage of the specified electrodes and their fasteners with clasp is that they are adapted to the human head and cannot be used for the transcranial electrical stimulation of animals.

The device for the transcranial electrical stimulation was chosen as the prototype. This device includes electrodes in the form of round metal disks, which are superimposed on the top of head and are fixed by the textile tape with fastener – "hook and pile" [3].

The disadvantage of the device-prototype is that there is necessary to cut out and to shave hair coat for the contact of its electrodes with skin. This greatly complicates the transcranial electrical stimulation of animals. Moreover the prototype fasteners cannot be applied because of different species and age features of animal head.

The aim of this work was to create the device for the transcranial electrical stimulation of animals.

For accomplishment of the aim the following tasks were defined: to increase the reliability of electrodes contact with animal scalp and to reduce the complexity through the use of electrodes made from the electroconductive studdable rubber and special rubber fastener with clasps.

METHODS

The scientific researches carried out in 2015 in the Department of therapy and midwifery, vivarium, veterinary clinic and scientific-experimental farm "Znamenskoe" of Federal State-Funded Educational Institution of Higher Education "Kursk State Agricultural Academy named after Professor I. I. Ivanov". The Romanow sheep were objects of the research. The beta-endorphin content was determined by the immunoenzyme method. This endorphin is an index of effectiveness of the transcranial electrical stimulation.

MAIN BODY

During the transcranial electrical stimulation the electrodes are placed on the animal head on occipital (anode) and frontal (cathode) regions of the head. The electrodes are fixed by rubber fastener. The Transair-2 device is connected to wires connecting to the electrodes and passing through holes in the rubber fastener than the transcranial electrical stimulation is conducted.

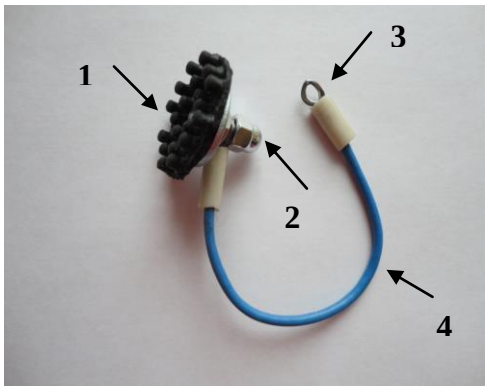

Figure 1: Modernized electrode.
1 – round disk of the electroconductive studdable rubber, 2– metal washer, 3 – clamping blind nut, 4 – electric wire.

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The offered device was used for the transcranial electrical stimulation of sheeps. Three groups of the animals were formed with this aim and 5 animals were in the each group.

The electrodes of developed construction, as you can see on the 1 figure, were used by the sheep of the first experimental group. These electrodes were placed on occipital (anode) and frontal (cathode) bones. The electrodes-prototypes were used by the sheep of the second experimental group. These electrodes were place on a sheep's head, as well as animals of the experimental group, after cutting out and shaving of the hair coat.

The electrodes were fixed on the sheep's head of the experimental groups with the use of the rubber fastener, as you can see on the 2 figure, which was made with configuration of an animal head.

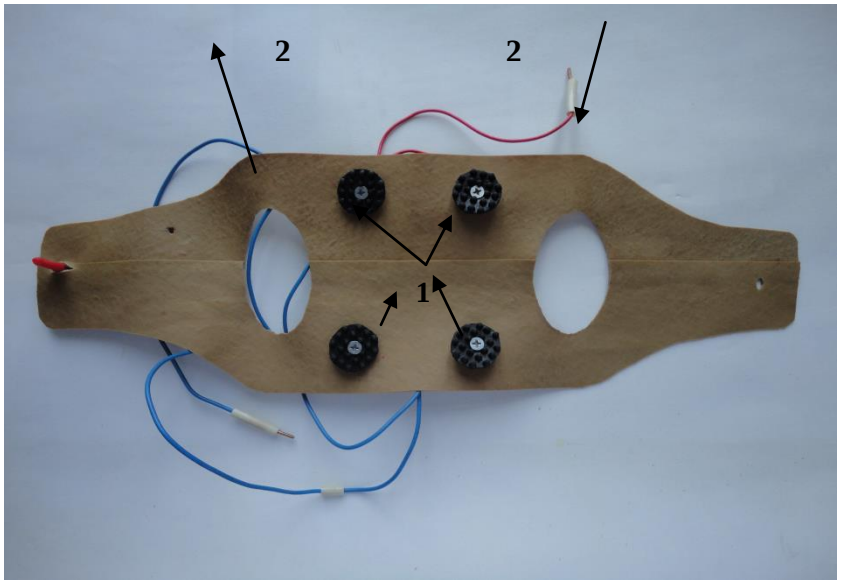

Figure 2: Rubber fastener

1 – holes for electrodes, 2 – clasp.

The sheep pf the third group were control, the electrical stimulation didn't conducted.

The transcranial electrical stimulation was performed with the apparatus "Transair -2" (manufacturer "Centre of the transcranial electrical stimulation", Research and Development Institute of Physiology named after I. P. Pavlov, city of Saint Petersburg) during 30 min. Before beginning of the electrical stimulation, after 30, 60 and 120 minutes after séance, the blood of sheep from the both groups was drawn. The beta-endorphin content in blood of the sheep was determined by the immunoenzyme method.

The experimental results have shown that the time spent for electrodes fixation of the developed construction was 4,5 min on the average, and during fixation of the electrodes-prototypes was 18-20 min.
The beta-endorphin content in blood of the sheep from the first and the second experimental groups significantly increased after the transcranial electrical stimulation. The differences between obtained values were statistically unreliable (p> 0, 05). The beta-endorphin content in blood of the sheep from the third control group slightly changed during the experiment.

CONCLUSION

Thus, the effects of the transcranial electrical stimulation were the same during use of the developed electrodes. However, use of electrodes made from electroconductive rubber and fastener cuts the time of their fixation and this reduces the complexity of the transcranial electrical stimulation of animals.

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SUMMARY

The modernized electrodes for the transcranial electrical stimulation of animals includes the electroconductive rounded plates and fastener with clasp. The fundamental difference from prototypes is that plates are made from electroconductive studdable rubber, and fastener is made from rubber with contours of animal's head and this fact assures reliability of the contact of electrodes with head skin of an animal and reduces the complexity of their fixation.

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