The Change of Peripheral Excitability Caused by Millimeter Waves

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***Abstract* – We conducted a double blinded prospective trial to evaluate the change peripheral excitability effect of millimeter waves (MW) under experimental conditions. Sixty healthy volunteers were exposed to active medical MW generator and to a disabled sham generator. Characteristics of continuous wave electromagnetic output from the active generator were: wavelength 5,6 mm incident power density 10 mW/cm^2 and duration of exposure 15 min and 30 min. MW produced a significant (p<0,0001) decreasing of peripheral sensibility in group with duration of exposure 30 min and non-significant decreasing of peripheral sensibility in group with duration of exposure 15 min. decreasing of peripheral sensibility (sensitivity) was appreciated by increasing of cronaxia – one of parameter of peripheral sensibility.**

With on average 200% of the 30 volunteers 11 (36,6%) reacted to the active MW generator with an decreased peripheral sensitivity by individual reactions varied from 300% to 345% comparison with their own preexposure levels.

MW therapy con be used as a supplementary or alternative treatment for decrease peripheral sensitivity for example peripheral pain.

I. INTRODUCTION

Electromagnetic millimeter waves (MW) are one of components of environment. Technical progress change wavelength, frequencies on incident power levels of millimeter waves. At present electromagnetic millimeter waves with incident power levels < 25 mW/cm have been used for medical purposes in several Eastern European chantries for more them a decade [1].

Our analysis of literature reveled the more material accumulated the present about biological effect and radiant energy of electromagnetic millimeter waves [2].

The first biological structures which feel MW action are peripheral skin structures: receptors, capillaries, organically and non-organically water solutions [3].

This is a very important feature of MW which con be used for study any peripheral effects and changes of any peripheral parameters.

Very few publications [2] contained clinical results with the use of MW obtained in a double-blinded manner. What because we effectuated a double- blinded study in healthy human volunteers for investigating changes of peripheral sensitivity in MW action. Sensitivity modification was studding by increasing or decreasing of cronaxie – one of parameters of peripheral sensitivity.

The results of our study are described below.

II. METHODS

Sixty volunteers participated in the study. The volunteers were students of University of Medicine and Pharmacy from Chisinau (R.Moldova). All students were informed about the physical and biological properties of MW and all of then gave their consent to participate in the study. The criteria for volunteers were: heating adults 18/20 yr old, none was a chronic pain sufferer or was taking any medication. Volunteers were divided in 2 groups by 30 in each group.

Volunteers from ferst group were exposed to an active and a sham MW generator with duration 15 min. Before and after exposition to MW generator we have recorded value of cronaxie.

Volunteers from second group was exposed to an active sham MW generator during 30 min, before and after exposition we have recorded cronaxie. In this way we a formed a baseline reading of cronaxie for each group of exposition. The medical MW generator "КВЧ универсал" used in this study emitted a continuants electromagnetic signal with frequency of 8 Hz (corresponding wavelength 5,6 mm) and incident power density of 10 mW/cm^2 . the hand skin between thumb and index finger (corresponding to biological active point G4) was exposed to the generator MW, the patient was sifting in an chair. The waveguide of the generator was located at the skin surface. The order of exposure of volunteers to an active and sham generator was varied randomly.

Cronaxie was recorded by system "Neoropuls" by active electrode located in the point G4: method begin by recording of rebases - minimal sensitive threshold and after then time action of double rebases will be cronaxie.

Two identical devices were used for exposure to electromagnetic MW and sham exposure. The output of the sham generator was disconnected, but all of the external features of both generators were the same.

The generators were marked 1 and 2 and the responses of the volunteers were analyzed separately.

Comparison of baseline readings with the results of true and sham exposures was performed by using Mann-Whitney U test. The level of significance was set at (P<0,001) for gust for one test.

III. RESULTS AND DISCUSSION

Possible adverse effects were monitored by observing the volunteers and by asking them questions about any reactions in time of exposition. No adverse effects of exposure to MW were noticed.

The response of volunteers exposed to MW 15 min peripheral excitability increase and cronaxie decrease by 4,2% (Fig.1).

The response of the same volunteers exposed to sham generator 15 min peripheral excitability decrease cronaxie increase by 14,3%.

The response of volunteers exposed to MW generator 30 min peripheral excitability decrease cronaxie increase by 21,2% ($p<0,0001$). The response of the same volunteers exposed to sham generator 30 min peripheral excitability decrease - by cronaxie increase by 19,9% (fig.2).

Our results indicate that MW produce decreasing of peripheral excitability in healthy volunteers . This is significant increasing ($p< 0, 0001$) of cronaxie in time of exposition to 30 min.

Exposition to 15 min or to shame generator not produce significant decreasing of peripheral excitability (in creasing of cronaxie).

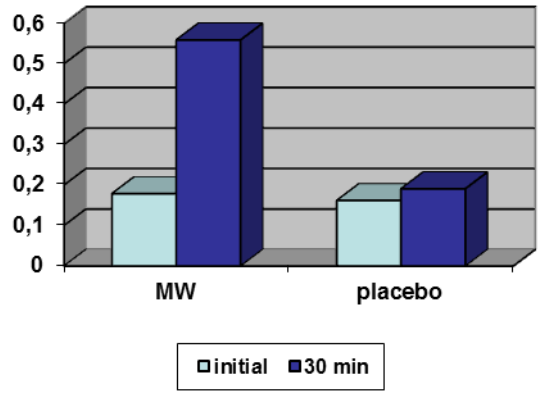

Fig.1. Changes of cronaxia in MW after 15 minutes.

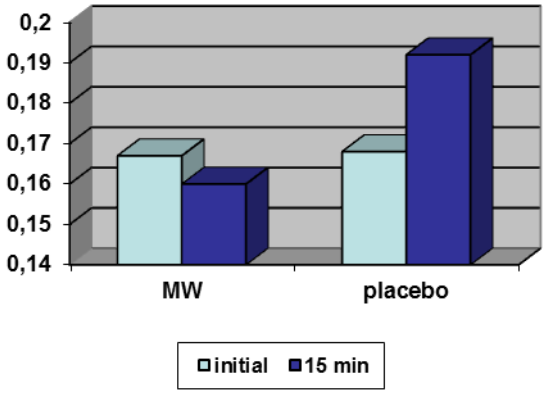

Fig. 2 Changes of cronaxia in MW after 30 minutes..

Our results, obtained under double-blinded conditions, show that a 30 min exposure to the MW produce in creasing of cronaxie one of the parameters of peripheral excitability. MW has three levels of interaction in human body: primary sensors of MW in the organism; pathwaystransmitting the signal to the regulating center; biological and chemical substrates implementing the response to the stimulus. Some clinical results indicate that the central nervous system participates in response to MW stimuli; for example, electroencephalogram changes were registered in healthy volunteers [6] and children with cerebral paralysis [7] as results of their exposure to MW.

Also the ability of neurons of organisms to react to low-power MW signals [5,6]. Thus nerve ending possibly participate in the primary reception of MW. Our results open any explication of this possibly mechanism. But, in summary, mechanisms of MW remain to be elucidated more.

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