

Whole Body Cryotherapy and Magnetotherapy Influence on Some Cardiac Parameters

A. Cholewka¹, Z. Drzazga¹, K. Michalik¹, A. Sieroń²

¹ University of Silesia, A. Chelkowski' Institute of Physics, Department of Medical Physics,
ul. Uniwersytecka 4, 40-007 Katowice, Poland

² Chair and Clinic of Internal Diseases and Physical Medicine, Silesian Medical University,
Batorego 15, 41-902 Bytom, Poland

Abstract

Electrical activities of the particular fragments of cardiac muscle due to magnetotherapy and whole body cryotherapy were estimated using high-resolution vectocardiography. Exposure on low frequency magnetic field as well as very low temperature didn't cause essential changes in heart rate from medical point of view. Only a little increase of electric activities of cardiac muscle was observed, especially after whole body cryotherapy.

Keywords: cardiac parameters, vectorcardiography, magnetotherapy, whole body cryotherapy

Introduction

The modern medicine is more often association of different kinds of medical treatment, which accelerate the recovery. Some of these methods that assist typical treatment are magnetic fields and very low temperature, which become popular techniques applied in medical therapy. However the knowledge about their biological and physical influence on human organism is still not well known thus objective studies are required.

The use of magnetic fields in medicine has attracted much attention in experimental and theoretical investigations [1, 2]. A number of studies of biological responses to exposure to electromagnetic field have been reported but the physical mechanism underlying magnetic field interaction with human organism has not been explained yet. There are a lot of works proving the bioactivity of extremely low frequency magnetic fields (ELFMF) on molecular, tissue and organism level in experimental studies. However there are papers treating pros and cons these physical factors [2].

In the last decade the whole body cryotherapy where patient is subjected in temperature below -100°C in the special room called low temperature chamber has developed quickly [3-6]. It takes only 2-3 minutes but it can cause the important effects in human organism. It was reported that whole body cryotherapy could be used in: degeneration and inflammatory states of joints (*monoarthritis* and *oligoarthritis*) and *periarthritis*, rheumatism, low back pain diseases, *sclerosis multiplex* and osteoporosis. The studies proved that the whole body cryotherapy causes reduction of pain and improved the physical fitness.

The aim of this work was to test the influence of magnetotherapy and whole body cryotherapy on cardiac parameters. In clinical practice the most important routine method for diagnosis heart diseases is electrocardiography (ECG). To better insight into heart work high-resolution vectocardiography can be used. This method allows viewing of the region of the depolarization wave propagation during the cardiac muscle evolution, so provides opportunity to detect even relatively small changes in electric

activity of particular segments of the cardiac muscle. It was reported that HRVEC could be promising in the diagnostic of ischemia diseases, cardiac infarct, drug treatment monitoring and during a patient rehabilitation [7, 8].

Materials and methods

The studies were performed on two independent groups of volunteers treated by chosen physical medicine methods. The 15 young healthy people (age $26,6 \pm 5,9$) were exposed to extra low frequency magnetic field (ELFMF) generated by therapeutic apparatus VIOFOR JPS during 8 min. The second group consisted of 25 patients aged $47,6 \pm 8,9$ suffering for low back pain subjected by temperature -120°C at the Silesian Centre of Rehabilitation and Physical Medicine in Ruda Śląska (GCR) where the two-stepped cryogenic chamber was installed. ECG records for each patient were made by MEDEA – KARDIOGRAF PC 5012 with software RKU before and after exposition (to ELFMF or very low temperature). Electric activities of particular segments of the cardiac muscle were obtained by the high – resolution vectocardiography (HRVEC) method [6]. Statistical analysis of results were performed with Statistica 5.1 using Student' t-test and Wilcoxon's tests for independent variables.

All patients were examined by the physician. They were requested not to smoke, drink alcohol or hot drinks for 4

hours before experiment. Ethical approval was obtained from the Ethical Committee of the Silesian Medical University (No.NN-013-144/I/02).

Results and discussions

Standard electrocardiography did not show any essential changes but the high-resolution vectocardiography could give additionally valuable information. Electric activity of particular segments of the cardiac muscle parameters for both studied patient groups are presented in Table 1. The results for young healthy subjects are similar to those reported in [9]. There were no significant changes in cardiac parameters for this group due to ELFMF exposition. More interesting seems to be results obtained for patients suffering from low back pain. Generally their cardiac activities are lower in comparison with healthy person parameters. It should be noted that a stay in the cryogenic chamber caused some increase of total activity (~10%) as well as of electric activities of particular segments of the cardiac muscle. Nevertheless changes in the main parameters before and after whole body cryotherapy were not statistically significant. However it was found that null hypothesis for some second-rate parameters of anterior septum obtained before and after cryotherapy session could be rejected with $p=0,02$. Therefore in our opinion a stay in the cryogenic chamber causing increase of heart electric

Table 1. Mean values \pm SD of electric activities of particular segments of cardiac muscle obtained before (a) and after (b) ELFMF and whole body cryotherapy.

Cardiac activities	ELF MF Activity [mV^2/ms]		Low temperature Activity [mV^2/ms]	
	a	b	a	b
Total activity (CC)	$61,7 \pm 29,4$	$59,4 \pm 24,4$	$44,8 \pm 21,8$	$48,9 \pm 28,8$
Anterior septum (PPG)	$10,6 \pm 7,3$	$11,3 \pm 7,7$	$3,9 \pm 3,9$	$5,5 \pm 5,8$
Anterior wall (SP)	$11,9 \pm 9,6$	$12,0 \pm 9,4$	$5,0 \pm 4,8$	$6,7 \pm 5,9$
Lateral wall (SB)	$19,4 \pm 10,8$	$20,1 \pm 10,8$	$17,6 \pm 8,9$	$18,6 \pm 10,9$
Left posterior branch (LOT)	$26,2 \pm 13,7$	$25,8 \pm 13,4$	$17,1 \pm 12,8$	$18,3 \pm 15,5$
Posterior wall (ST)	$20,9 \pm 16,4$	$19,7 \pm 14,7$	$11,7 \pm 9,3$	$12,7 \pm 10,5$
Interior wall (SD)	$12,9 \pm 11,0$	$11,8 \pm 10,1$	$9,3 \pm 9,3$	$9,9 \pm 11,5$
Basal anterior segment (Fpa)	$7,6 \pm 6,2$	$7,6 \pm 6,2$	$4,5 \pm 4,9$	$5,5 \pm 7,9$
Basal posterior segment (FPb)	$6,3 \pm 4,9$	$6,3 \pm 4,9$	$8,2 \pm 5,2$	$8,5 \pm 4,9$

activity could be interpreted as a positive effect of whole body cryotherapy. These results seem to be in a good correlation with improvement of health condition of the patients after cold treatment.

Conclusions

Our results showed that whole body cryotherapy and magnetotherapy do not upset the heart work. A little tendency to increase of heart activity particularly after whole body cryotherapy could be interpreted as a positive influence of cold treatment on heart.

References

1. Sieroń A. (ed.): Zastosowanie pól magnetycznych w medycynie. *α-medica press*, Bielsko-Biała, **2000**.
2. Stavroulakis P. (ed.): Biological effects of electromagnetic fields, Springer, Berlin **2003**.
3. Metzger D., Zwingmann C., Protz Wand Jackel W. H.: Die Bedeutung der Ganzkörperkaltetherapie im Rahmen der Rehabilitation bei Patienten mit rheumatischen Erkrank. *Rehabil.* **39**, 93 – 100, **2000**.
4. Z. Zagrobelny (ed.): Local and whole body cryotherapy Urban&Partner Wrocław Poland **2003**.
5. Sieroń A., Cieślak G. (ed.): The application of cold in medicine – cryosurgery and cryotherapy. *α-medica press* Bielsko-Biała Poland **2003**
6. Cholewka A., Drzazga Z., Michnik A., Sieroń A., Wiśniowska B.: Temperature effects of whole body cryotherapy determined by thermography *Thermol Intern* **2**, 14, 57 – 63, **2004**.
7. Krzyminiewski R., Panek G., Stępień R.: The changes in electrical activities of the particular fragments of the cardiac muscle in linear transformed ECG recordings, *Proceedings of the EMBEC Vol.* **3**(1), 570-571, **2002**.
8. Krzyminiewski R., Panek G., Stępień R.: Correlation of results of coronarographic, spect examination and high-resolution vectocardiography. *Medical & Biological Engineering & Computing Vol.* 37 Sup. **2**, 514-515, **2002**.
9. <http://www.staff.amu.edu.pl/~zfmed/research.html>