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Research Article

Hydroterapeutic Methods in the Prevention and Treatment of Hypertension

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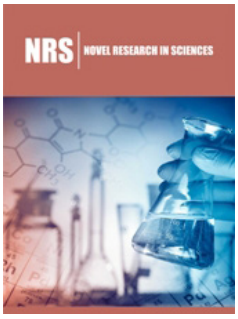

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Abstract

Introduction: Cardiovascular disease is the main cause of mortality worldwide and constitutes a serious clinical and social problem.

Aim: To present the possibility of using selected hydroterapeutic procedures in the prevention and treatment of cardiovascular disease.

Material: The paper presents treatment outcomes of 80 patients with grade 1/2 hypertension who underwent a series of procedures involving water jets at alternating temperatures.

Results: After treatment with water jets at alternating temperatures, the blood pressure of patients with hypertension returned to normal.

Conclusion:

a) Selected hydroterapeutic procedures may be more widely used to prevent and treat cardiovascular disease.

b) There is an urgent need to promote the use of these procedures, both among doctors and the general public.

Keywords: Hypertension; Prevention; Treatment; Hydroterapeutic procedure

Abbreviations: CVD: Cardiovascular disease; HRV: Heart Rate Variability

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Introduction

Cardiovascular disease (CVD) is the main cause of mortality worldwide, leading to 31% of all deaths. With the progress of civilisation, CVD has become increasingly widespread and is now seen as a 21st century epidemic [1-10]. According to the World Health Organisation, over 75% of CVD cases could be avoided by eliminating risk factors and early detection of cardiovascular abnormalities, which makes preventive measures particularly important. Research indicates that hypertension is one of the most common cardiovascular risk factors [1-18]. Thousands of people experience a stroke due to hypertension every year and there situation can be avoided by prophylactic use of hydroterapeutic methods in patients [19-24]. The sympathetic nervous system is one of the key factors involved in the development of hypertension and its complications.

By acting on the central and peripheral mechanisms, the adrenergic system regulates blood pressure both in the short and long term. Short-term blood pressure regulation involves peripheral vasoconstriction and tachycardia; the long-term regulation is influenced by a number of complex processes. Through stimulation of the juxtaglomerular apparatus receptors, sympathetic fibres increase the production of renin, which activates the renin-angiotensin-aldosterone system. Angiotensin II increases nerve conductivity by stimulating the adrenergic centres and increasing the synthesis and release of norepinephrine. In turn, aldosterone contributes to an increase in sodium resorption and intravascular blood volume. Moreover, excessive long-term stimulation of the sympathetic system may lead to cardiac hypertrophy, vessel wall remodelling, and endothelial function impairment.

Reduced nitric oxide production by the damaged endothelium is associated with positive feedback in the form of sympathetic system stimulation. The influence of the sympathetic nervous system on the cardiovascular system may be regulated with both pharmacological and non-pharmacological methods. Hydrobalneotherapy is an important non-pharmacological method; it uses the thermal and hydrostatic properties of water and natural therapeutic factors found in spa waters to influence body functions. Hydroterapeutic methods have long been used in the prevention and treatment of cardiovascular diseases [20-24]. Therapeutic methods combining balneology and hydrotherapy have been used in treatment and prevention for a long time.

Hippocrates recommended the therapeutic use of water as early as in the 4th century BC. Josephius Struthius, a personal doctor of Polish king Sigismund II Augustus, greatly supported these methods of treatment. In 1578, Ocellus published a treatise titled "Cieplice", presenting bath recipes as well as first indications and contraindications for their use. In the 20th century, the methods of hydrotherapeutic and balneological treatment were further developed thanks to Dr Żniniewicz and Professor Jankowiak. The development of research methods in the second half of the 20th century allowed specialists to partially explain the mechanism of action of the treatment on the human body. The use of half-sitting warm water baths recommended by Kneipp in patients with symptoms of angina turned out to be scientifically justified. The baths cause increased secretion of the atrial natriuretic peptide which has a vasodilatatory effect [20-22].

Hydrotherapeutic and balneological procedures are used due to their multidirectional stimulating influence on the body, i.e. mechanical, thermal, and hydrostatic influence of water on the skin, which results in further responses of the body. The stimulation of skin receptors causes a reaction of skin blood vessels and influences the entire body by abdominal reflexes, leading to a reaction in the internal organs. Acting on large areas of skin, they cause the vessels in the chest and abdominal cavity to react in the opposite way to the skin vessels. The skin with its receptors, a double artery system and arteriovenous communication is an appropriate area for the influence of thermal and mechanical stimuli. Thermal stimuli cause vasodilation in the skin, open inactive capillaries, and lead to secondary changes in the volume of blood circulating in various organs. Warm baths decrease blood pressure, accelerate breathing, increase lung ventilation and renal secretion.

Cold baths influence the neuroendocrine system, causing increased corticosteroid, 17-ketosteroid, THS and thyroxine secretion. Cold activates the adrenergic system and increases metabolism. Alternating temperatures increase local release of noradrenalin, 5-hydroxytryptamine, acetylcholine, and histamine in the skin, which influences vital organs. Hydrotherapeutic and balneological procedures also have an effect on the conduction and its velocity in motor and sensory nerve fibres. The body's reaction to thermal and hydrodynamic stimuli depends on the condition of the skin and subdermal tissue, body weight, age, gender, and the condition of the autonomic nervous system. Functional antagonism between parts of the autonomic system is visible on the level of innervated organ structures as well as the central nervous system. There is a mutually inhibitory influence of neurons consisting in the modulation of the release of final mediators in postganglionic sympathetic and parasympathetic neurons.

Vagus nerves and acetylcholine released by postganglionic neurons of the parasympathetic system decrease cell excitability. Sympathetic nerves and noradrenalin, which is a mediator in the synapses of postganglionic neurons of the sympathetic system, cause increased cell excitability in the innervated organs. Respiratory neurons regularly change central sympathetic and parasympathetic tone, thus significantly influencing the systems' activity. Thermoregulation involves a local and a systemic response. Skin receptor outflow is transmitted by autonomic afferent pathways to the central nervous system. The type of response and its complexity depend on central nervous system level on which the peripheral signals are integrated. Connections between somatic and autonomic parts of the nervous system on the spinal cord level are the basis for abdominal reflexes. Reflex arcs of somatic autonomic reflexes intertwine and the stimuli from internal organ receptors reach the same ganglionic neurons which receive signals from the skin receptors.

Hydrotherapeutic and balneological procedures result mainly in changes in blood circulation. Studies on the influence of these procedures on autonomic nervous system activity have been conducted for a long time, but it were the technological advances of the second half of the 20th century that allowed scientists to create diagnostic methods assessing this influence on the human body. Studies conducted at the Department of Rehabilitation with the Division of Physical Medicine (Military Medical Institute) on the influence of selected hydrotherapeutic and balneological methods on the human body showed a positive influence of water jets of alternating temperatures in the treatment of functional disturbances of the cardiovascular system. The use of non-invasive diagnostic methods of assessment of autonomic nervous system function, including an analysis of Heart Rate Variability (HRV), revealed a statistically significant increase in the HF, r-MSSD and pNN50 indices after a series of procedures, indicating increased activity of the parasympathetic part of the autonomic nervous system. The procedures resulted in increased HF and HRV.

Material and Methods

The study was conducted at the Department of Rehabilitation at the Military Medical Institute in a group of 80 patients with grade 1/2 hypertension who underwent treatment with water jets at alternating temperatures. The patients' radiographic ECG tracing and blood pressure were monitored. The function of the autonomic nervous system was assessed with non-invasive diagnostic methods, including Heart Rate Variability (HRV) analysis; after treatment, the assessment showed a statistically significant increase in the values of HF, r-MSSD, and pNN50, indicating a higher tone of the parasympathetic part of the autonomic nervous system. The procedures extended the cardiac spectrum with respect to high frequencies and increased heart rate variability.

Statistical methods

The data collected in the study was statistically analysed. The following was calculated: arithmetic mean, standard deviation, median, minimum and maximum values. The effectiveness of rehabilitation was determined based on a comparison (using paired-sample Student's t-test) of pre- and post-water jets data at a significance level of $p<0.01$. The calculations were performed using Statistica 13.1.

Results

After 2-week treatment with water jets, blood pressure decreased from the baseline value of 160-195/95-115 to the post-treatment value of 145/85 (Figure 1). Before the procedures, the mean blood pressure in the study group was 160-190±10 and the diastolic pressure was 105 to 115mm Hg. After 15 treatment sessions, the respective values were:

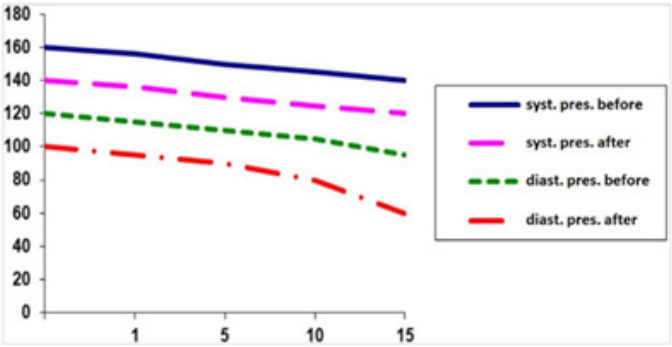

Figure 1: Blood pressure before and after procedures.

a) Systolic-145±10, p-value<0,001

b) Diastolic-85±9mm Hg, p-value<0,001

Water jets of alternating temperatures are great for modulating the activity within the autonomic nervous system and increase its parasympathetic activity. The Zung Anxiety Scale showed that the anxiety score was higher before the procedures and considerably decreased after the series of water jets at alternating temperatures, which confirms a very beneficial influence of the procedures on the patients' psychosomatic status. The water jets perfectly modify the tone of the autonomic nervous system and increase the parasympathetic tone.

Discussion

The study presented the possibilities of regulating the function of the autonomic nervous system under the influence of selected methods of hydrotherapeutic treatment and thus influencing the body's functional level best adjusted to the requirements of the internal and external environment of the body. Current capacity of the body to react to stimuli depends on the functional status of its autonomic system. The excitability of the sympathetic or parasympathetic systems decreases with an increasing level of their activity. The more increased the function of an organ or system, the higher the possibility of decreasing it under the influence of inhibitory stimuli.

The procedures are mainly indicated in:

a) Functional Abnormalities of the cardiovascular system

b) Grade 1/2 hypertension

c) Neurovegetative dystonia

d) Mental and physical exhaustion

e) Spa Biological regeneration

Conclusion

a) Cardiovascular disease is a clinical and social problem.

b) Hydroterapeutic procedures provide extensive possibilities of influencing the autonomic system and, indirectly, the cardiovascular system.

c) There is an urgent need to promote the use of these procedures, both in the prevention and treatment of selected cardiovascular disorders.

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