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## BALNEOTHERAPY IN POST-SURGICAL RECOVERY FOR PATIENTS WITH BREAST NEOPLASMS AT THE RESORT (LITERATURE REVIEW)

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**Key words:** breast neoplasms, post-surgical recovery, spa treatment, balneotherapy, heat shock proteins.

Annotation. This literature review is devoted to the conduct of balneotherapy during post-surgical recovery for patients with breast neoplasms at the resort. The article discusses indications and contraindications for spa treatment of this category of patients. Referral to the resort is possible due to post-mastectomy complications and concomitant diseases, which is determined individually after consultation at the oncology centre. The authors assess the role of heat shock proteins in the biological mechanisms of balneotherapy, focusing on the indications and contraindications for balneological procedures.

**Introduction.** Success achieved by oncology in the field of breast neoplasms (BN) therapy using high-technology methods of diagnostics and treatment is laying the groundwork for faster patient healing and recovery [5, 24, 29, 42]. On the other hand, it is accompanied by the increase of survivability and life expectancy of patients, improvement of life's quality, which are the basic criteria of efficiency in oncology patients' recovery system [11, 25, 37]. Surgical intervention (in case of malignant breast neoplasms - the use of radiation and drug therapy) can lead to various disorders, such as the post-mastectomy syndrome, brachial plexus injuries,

neuropathy, limitation of movement amplitude in glenohumeral joint from the side, which was operated, and severe depression [1, 6, 10]. For patients with benign breast neoplasms unsatisfactory cosmetic post-surgery results can cause body dismorphic disorder, depression, decrease of self-esteem and social maladjustment [40].

All mentioned above point out a necessity to conduct a post-surgical recovery for patients, ideal option of which is the spa treatment [22].

Methods and organization. Research method: Analysis of scientific methodological literature.

**Results and discussion.** The spa treatment includes medical assistance provided by spa organizations for preventive, treating and recovering purposes on the basis of using natural curative resources in conditions of being in health and recreation areas and resorts. Spa treatment aims for [28]:

- activation of defensive and adaptive reactions of the body in order to prevent sickness, for healing;

- recovery and (or) compensation of body functions, which were impaired due to injuries, surgeries and chronic illnesses, decrease of aggravation, elongation of disease-free survival, slowdown of diseases development and prevention of disability as one of the stage of medical recovery.

Giving a multi-organ sanogenetic effect, the spa treatment supports an increase of adaptive possibilities of functional systems and psychophysiological abilities of patients and serves also as a non-specific therapy, which recovers physiological reactions of oncology patients' adaptation [3, 15]. One of methods of spa treatment is balneotherapy, which, according to encyclopedia dictionary of medical terms, is a combination of treatment, prevention and recovery methods, based on use of mineral waters and therapeutic muds [31].

Balneotherapy, which is also called spa therapy [48, 53], is widely used in many countries in everyday clinical practice for various diseases treatment. However, despite all popularity, long history and using traditions, its scientific significant is still an object of discussions, its scientific data about the effectiveness or efficiency is scarce [35, 53]. That is why the purpose of this review is an elevation from the perspective of modern positions of importance of balneology for post-surgery recovery of patients with breast neoplasms at the resort.

**Indications and contraindications for spa treatment.** The viability and effectiveness of medical recovery for patients with breasts neoplasms at the resort are out of question for oncologists, because it can significantly improve results of therapy, increase the 5-year survival and decrease a duration of work incapacity [26].

However, according to the Order of the Ministry of Health of Russia №321n from 07.06.2018 "On approval of lists of medical indications and contraindications for spa treatment" the second (II) disease type, which are Neoplasms, is absent in the List of medical indications for spa treatment [20].

Thus, T.I. Grushina suggests [6] that indications for referral to the spa treatment can be complications of combination therapy and concomitant diseases, which do not contradict the above-mentioned document. Complications of combined treatment of breast cancer include I-II degree lymphatic edema of higher extremity located on the side of performed surgery, functional disorders of cardiovascular and nervous systems. In this case, it is recommended to send patients to specialized sanatoriums and resorts of cardiovascular profile. The beginning time of the spa treatment after the end of combination treatment of breast cancer is not earlier than 3-6 months for local sanatoriums and not earlier than 6-12 months for southern resorts in autumn- and wintertime. Patients, who received combination treatment of breast cancer and who do not have relapse and/or metastases, are recommended to receive the spa treatment in concern of concomitant diseases, such as diseases of blood flow and digestion organs, functional diseases of nervous system, bronchi diseases and non-tuberculosis lung diseases, chronic pyelitis, kidney stone disease, metabolic disorders, endocrine system and organs of sight diseases.

Moreover, diseases related to neoplastic process are included in the List of medical contraindications for the spa treatment (Appendix №3 of the Order of the Ministry of Health of Russia from 07.06.2018 №321n) [20, 30]:

- p. 7. Diseases accompanied by persistent pain syndrome requiring constant intake of narcotic and psychotropic substances included in I and II Lists of narcotic and psychotropic substances and their precursors, which are subjects to control in the Russian Federation and are registered as medications;

- p. 9. Neoplasms of non-specific nature (without written approval in the patient's medical record that the patient (or their legal representative) is warned about possible risks related to complications of the disease due to the spa treatment);

- p. 10. Malignant neoplasms, which require antineoplastic therapy, including chemotherapy.

Apart from general contraindications established by the Order of the Ministry of Health of Russia from 07.06.2018 №321n, there are special contraindications related to particular characteristics of spa factors and the oncology disease, nature of consequences of antineoplastic therapy's complications and accompanying pathology. Thus, the spa treatment is not recommended to:

- I group patients of oncologic dispensary with suspected breast cancer, unless the suspicion is proven wrong;

- II group patients who are subject to the combination treatment, including those, who have not finished adjuvant treatment including continuing courses of radiation and chemo-hormonal therapy;

- III group patients with suspected relapse or tumor metastasis, unless the suspicion is proven wrong;

- IV group patients with an advanced neoplastic process, who are subject only to the symptomatic treatment, even if their condition is satisfactory;

In addition, the spa treatment is not recommended to patients with breast cancer, who have [6]:

- consequences and complications of radical antineoplastic treatment in the form of radiation ulcers and skin and mucous membrane wounds (in addition, after chemotherapeutic agents injections);

- concomitant diseases of musculoskeletal and peripheral nervous systems, chronic inflammatory diseases of female reproductive system, skin diseases and chronic diseases of ENT-organs, which require thermal procedures, mud therapy, and also treatment in southern resorts in summertime;

- the need of active ambulatory or stationary treatment due to severe consequences of the combination therapy;

- unfavorable individual expected response to treatment of neoplastic process.

According to T.I. Grushina [6], after termination of such disorders after the ambulatory or stationary treatment, a second discussion about the issue of acceptability of the spa therapy can take place. In all cases, a referral for treatment is given to the patient with breast neoplasms individually, after a consultation in the oncology center. Medical selection is carried out in the same order as for all other patients, but it is mandatory to present to the physician in charge a medical note from the oncology center, in which the patient was registered. While deciding on a possibility to give the spa treatment before giving a medical note, the oncology center, regardless of the follow-up period of the patient, does a thorough observation using all necessary modern diagnostic methods in order to exclude relapses and tumor metastases. The period of note's validity is 1 month. After the spa treatment, the patient is to be observed by the oncologist once every 3 months. If signs of breast neoplasms' progress are absent and the efficiency of the spa treatment is proven, the physician in charge in cooperation with the oncologist should discuss the issue of the patient's referral to the resort or the sanatorium.

The role of heat shock proteins in biological mechanisms of balneotherapy. Balneotherapy is used on the base of experience at all times and it is one of the oldest types of therapy to relieve the pain syndrome of patients [51]. Mechanisms of physiological actions of balneological factors are the result of complex synergetic combination of mechanical, thermal and chemical exposure [35,

44, 52]. Regardless of which of those mechanisms are used in higher or lower degree, physiological reactions, which appear during that time, include mainly neuroendocrine and immunologic effects, causing anti-inflammatory, analgetic, antioxidant, chondroprotective and anabolic effect [38, 44]. Balneotherapy is an efficient, easily endured mean of treatment of diseases of such systems as cardiovascular, respiratory, digestive, endocrine and nervous system, and also diseases of the musculoskeletal apparatus and skin [36, 38].

During last years, there is a tendency of a wider use of physical factors in medical recovery of oncologic patients at different moments of the post-surgical period [14, 57]. However, some of the types of balneology have a strong biological effect on human's functional systems and organs, stimulating an increase of neoplasms and an advancement of the neoplastic process [6, 7, 8]. Because of that main contraindications for all oncology patients, including those with breast neoplasms regardless of the end period of the combination treatment, are all types of therapeutic muds, internal and external use of radon, sulphurous, arsenic and nitrogen mineral waters.

Temperature plays a central role in balneotherapy effects. Therapeutic mineral waters and muds are commonly used externally and heated, because they are considered as great heat providers, as they can keep the heat longer and give it slower [39]. As a result of using increased temperature (38°C to 42°C, as a rule), heating therapeutic effects are more pronounced [34, 38]. Besides that, local and generalized physiological effects in the body are manifested through chemical and biological properties of balneological factors [45], which, however, are hard to identify and evaluate [34].

The effect of balneotherapy on neuroendocrine system in general is explained by the heat stress caused by the increased temperature of use. Therefore, heat stress induce a reaction of heat shock (HS) and, consequently, synthesis and release of heat shock proteins (Hsp) [18, 38], which was discovered in 1974 by A. Tissieres et al. [50]. Support of heat shock reaction during an additional heat stress causes hormonal imbalance in the body [43], which can play a certain role in beneficial balneotherapy effect [49].

Later it was discovered that the Hsp synthesis is induced not only during temperature increase, but also during many other effects. It includes cases when mineral water or peloid has specific biochemical components, which are hydrogen sulphide (H<sub>2</sub>S) in sulphuric water or radon in radioactive water [38], and organic solvents, hard metals, strong oxidants, some hormones and growth inducing substances [41]. According to modern data, Hsp synthesis is a universal non-specific cell answer to stress [33]. Therefore, some researchers are calling Hsp "stress proteins" [2]. An excessive Hsp expression regarding a wide range of malignant

neoplasms, their participation in proliferation, differentiation, invasion and metastasis of cancer cells [32]. An excessive Hsp expression can also predict an answer to some anti-neoplasm methods of treatment, in particular – heat shock proteins (Hsp27 и Hsp70) are involved in tolerance to chemotherapy for patients with breast cancer [32, 47].

**Balneological procedures for post-surgical recovery.** The foundation of balneotherapy includes methods of using mineral waters and therapeutic muds. Due to aforementioned reasons, all types of peloids, internal and external use of radon, sulphurous, arsenic and nitrogen mineral waters are prohibited in oncology. All those types of mineral waters are called balneological, because they are normally used externally [6, 7, 8]. Components of mineral waters include biologically active gases (CO<sub>2</sub>, H<sub>2</sub>S, Rn) and specific micro components (Br, J, H<sub>2</sub>SiO<sub>3</sub>, H<sub>2</sub>BO<sub>3</sub> and others). Balneological waters differ from mineral drinking waters by the level of general mineralization, ion composition and physical properties. Those types of water usually have a high degree of mineralization, up to 20 grams per liter, which is predominantly a chloride natrium composition. Balneological waters are used topically – baths, therapeutic showers, in some cases, depending on diagnosis and water composition, they can be used for inhalations, enema procedures and therapeutic irrigation [12].

Balneological procedures are conducted for prevention, therapy and recovery of concomitant diseases of musculoskeletal apparatus [35, 48, 53], diseases of skin and cardiovascular system, gynecologic and neurologic pathologies [17, 23]. During the spa treatment after the combination therapy for breast neoplasms patients should receive balneotherapy in the form of tepid baths (with the water temperature of 34-36°C) 10-15 minutes long. According to their composition, bubble, pine bubble, licorice, lavender and iodine-bromine baths can be used [8]. After segmental mastectomy for benign breast neoplasms patients successfully received balneotherapy in the form of general iodine-bromine baths (with the temperature of 37°C, course of 10 procedures 15 minutes each), patients with chronic inflammatory diseases also received therapeutic vaginal irrigation with iodine-bromine water [4]. Patients with the post-mastectomy syndrome successfully receive chloride natrium baths [46].

Mineral drinking waters are those with the mineralization rate not less than 1 g/dm<sup>3</sup>, and natural waters with mineralization less than 1 g/dm<sup>3</sup> with biologically active microelements in quantity not less than those in regard of balneological standards, accepted for mineral drinking waters (GOST 13273-88 "Mineral drinking therapeutic and therapeutic-table waters"). According to ion-saline composition, mineral drinking waters are divided into 31 groups. In the treatment practice, a classification of mineral drinking waters regarding their anion composition is used

more frequently, because indications for using waters with various cation compositions are the same for many diseases [13, 16].

The variety of clinical effects, good endurability, ability to stimulate adaptive reactions, increase of tolerance of the body and the relative cheapness allow to use mineral drinking waters broadly during treatment of chronic diseases of digestive system [16, 19, 21].

**Conclusion.** Thus, carrying out the post-surgical recovery of patients with breast neoplasms due to complications of the combination treatment and concomitant diseases is determined individually after a consultation in the oncology centre. Moreover, there are contraindications for using therapeutic muds and using radon, sulphurous, arsenic and nitrogen mineral waters externally and internally. This is due to the presence of specific biochemical components in before mentioned peloids and mineral waters, which cause the appearance of stress proteins (heat shock proteins) possessing an ability to participate in proliferation, differentiation, invasion and metastasis of cancer cells, that is, they can stimulate growth of neoplasms and progression of the neoplastic process. Moreover, iodine-bromine and chloride natrium mineral waters in the form of general tepid baths and mineral drinking waters can be used for prevention and treatment of post-mastectomy complications and accompanying operations during post-surgical recovery of such patients at the resort.

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