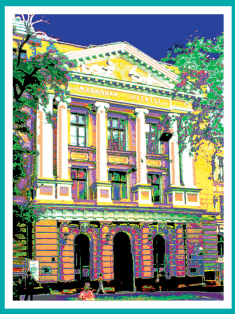

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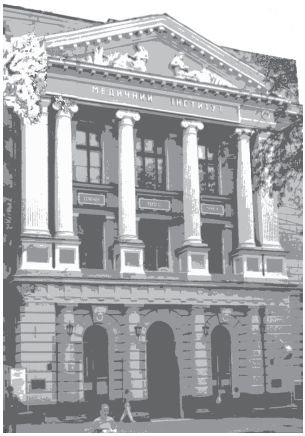
# FOUNDATIONS OF GENERAL PHYSIOTHERAPY, MEDICAL REHABILITATION AND BALNEOLOGY

ОДЕСЬКИЙ МЕДУНІВЕРСИТЕТ

**ОДЕСЬКИЙ ДЕРЖАВНИЙ МЕДИЧНИЙ УНІВЕРСИТЕТ**

**THE ODESSA STATE MEDICAL UNIVERSITY**

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# FOUNDATIONS OF GENERAL PHYSIOTHERAPY, MEDICAL REHABILITATION AND BALNEOLOGY

*Recommended*
*by the Ministry of Education and Science of*
*Ukraine as a manual for students of higher*
*medical educational establishments of*
*the IV level of accreditation and doctors-interns*

**Odessa**
**The Odessa State Medical University**
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*Authors:* I. P. Shmakova, Yu. V. Prokopchuk, G. A. Shapovalova

*Reviewers:* Prof. V. V. Yezhov, MD, the head of the Physiotherapy Department of the post-diploma education faculty of the Crimean State Medical University named after S. I. Georgievsky

Prof. V. P. Lysenyuk, MD, the head of the Neurology and Rehabilitation Medicine Department of the National Medical University named after O. O. Bogomolets

The manual presents general information on physiotherapy, balneology and medical rehabilitation. Modern technologies of rehabilitation treatment and classification of physical factors are presented in the book. Peculiarities of administration of physical factors are given as well. There are described modern approaches to natural and preformed therapeutic factors application.

For students, interns, physiatrists and doctors of different specialities.

**Шмакова І. П. та ін.**

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У навчальному посібнику представлена загальна інформація з фізіотерапії, бальнеології та медичної реабілітації. Надаються сучасні технології реабілітаційного лікування, а також класифікація фізичних факторів. Наводяться особливості застосування фізичних факторів. Описані сучасні підходи до застосування природних та преформованих факторів.

Для студентів, лікарів-інтернів, фізіотерапевтів, лікарів різних спеціальностей.

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# INTRODUCTION

Modern physiotherapy uses a great arsenal of natural and preformed physical medical agents. In many countries, besides common apparatus and nonapparatus physical factors physiotherapy includes: kinesitherapy, massage and conservative orthopedics (corsets, collars, bandages, dressings, etc.).

Physiatrists apply physiopuncture and physiopressure more and more often taking into account canons of acupuncture reflexotherapy. Recently physiotherapy has begun to include a number of variants of therapies with oxygen, ozone, carbonic and other gases (normobaric hypoxia, hyperbarooxygen therapy, singlet-oxygen therapy, ozone therapy, application of carbogene, hyperbaric carboxytherapy, etc.).

Physical pharmacotherapy is being developed: electrophoresis with medicinal substances with various currents and fields, ultraphonophoresis, medicinal inhalations and baths, medicinal massage, etc.

Progress of medical science and technology includes fast evolution of many sections of physiotherapy: application of various lasers, magnets, impulse currents, ultrasound and sound, microwaves, facilities of photo and mechanic therapy, balneo- and climate therapies.

Physical factors can be administered in the acute, subacute and chronic periods of diseases. Potentials of physiotherapy in home conditions (see chapter 1) are great.

The role of physical prophylaxis in sanitation of people increases. It's carried out by means of water, air-, ultraviolet, aeroionic and hydroaeroionic procedures, especially in combination with the increased motor performance, methods of exercise therapy — physical kinesiprevention.

Physiotherapy and exercise therapy (ET) are the basis of medical rehabilitation. It should be remembered by each physician that alongside with enormous achievements in the field of pharmacotherapy, it has many disadvantages: medicinal allergy, intoxication, anaphylactic shock, side-effects,

damage of the tissues of the stomach, intestine, liver and kidneys in internal application of medicines, medicinal dependence, etc.

Pharmacotherapy is especially effective in the acute periods of diseases and traumas but it is not in the first place in chronic pathology, at the stages of medical rehabilitation.

Treatment in sanatoria and at health resorts is based mainly on the use of natural physical factors: mineral water, medical muds, micro- and macroclimate therapies, ozokerite (in Ukraine), and to a lesser degree on application of apparatus physiotherapy.

In Ukraine there are a lot of large, middle-size and small health resorts: climatic, balneal, mud, with special resort factors. Berdyansk, Evpatoria, Zakarpatye and Kiev resort regions, Alushta, Alupka. Mirgorod, Morshin, Odessa, Saki, Slavyansk, Truskavets, Khmelnik, Yalta are the climatic resorts. Each health resort has a combination of natural medical agents, its own medical profile (see Appendix 3). With proper organization of resort business (medical care, service, feeding, modern organization of entertainments) our health resorts can be attractive to many Europeans. In the republic there are over 100 sanatoria — rehabilitation departments of different profile as well as specialized sanatoria for rehabilitation treatment of patients suffering from tuberculosis and traumas of the spine and spinal cord.

This book is mainly intended for the students of medical universities, interns of different specialities; it also can be useful to the young doctors who are specializing or are on probation training in physiotherapy and medical rehabilitation.

*Chapter 1*

# PLACE AND ROLE OF PHYSIOTHERAPY, BALNEOLOGY IN THE SYSTEM OF PUBLIC HEALTH OF UKRAINE. CLASSIFICATION OF PHYSICAL MEDICAL FACTORS. GENERAL NOTIONS OF THE MECHANISM OF THEIR ACTION. MEDICAL REHABILITATION

## 1.1. General Notions. Place and Role of Physiotherapy in the System of Public Health Care of Ukraine

**Physiotherapy** is a medical science studying mechanisms of physiological and medical effect of natural and preformed physical medical agents on a person and animals, as well as issues of the organization of physiotherapeutic services in medical establishments.

**Physical prophylaxis** is a preventive, health-improving application of physical factors within primary, secondary and tertiary prophylaxis. Water, air, solar and ultra-violet rays, the artificial aeroions, the dosed exercise loading for the general improvement are mainly used for primary prophylaxis. Secondary prophylaxis is directed at prevention of development of concrete diseases (vibratory disease, pneumoconiosis, rheumatic disease, etc.) in presence of risk factors. All arsenals of physical medical agents can be applied for prevention of advanced development and relapses of the disease in tertiary prophylaxis.

**Balneology** is a science about preventive and medical application of natural physical medical agents: mineral water, muds, curative climates, ozokerite, naphthalanum, etc. as well as about the organization of health resort business.

**Medical rehabilitation** is a science about mechanisms, peculiarities and methods of rehabilitation treatment of various groups of patients. It has gained special development in cardiology, orthopedics, traumatology, neuropathology, pediatrics and phthisiology. Physical medical agents (including kinesitherapy) are widely used in medical rehabilitation.

Modern physiotherapy possesses a huge arsenal of the apparatus and nonapparatus methods of treatment: apparatuses of impulse currents, microwaves, magnetic fields, laser and ultraviolet radiation, ultrasound, vibratory actions, scores of bath designs, douches, etc. There were greatly

developed the following physical methods, such as physical puncture (laser, electric, thermal, magnetic, etc.), physical pharmacotherapy (electro- and phonophoresis with medicinal substances, medicinal baths, inhalations, massage).

Physiotherapeutic rooms or units are available almost at each medical establishment. They can be specialized intended for patients of one profile, or versatile, usually, in large hospitals and out-patient departments. Physiotherapeutic rooms and halls of physiotherapeutic exercises make a basis for departments of rehabilitation treatment: in-patient and out-patient departments, hospitals, sanatoria.

Sanatorium establishments build their health improving and medical work on the basis of developed physiotherapies and ET. The structure of physiotherapeutic departments usually includes rooms of electro-, photo-, water-, thermo- and mechanic therapy, medical inhalations, etc.

**Health resort** is a locality possessing natural medical factors (mineral water, medical mud, favorable climate, etc.) where establishments on their application are placed: sanatoria, boarding houses, resort out-patient departments, physical balneoclinics, pump rooms and rest-homes.

There are balneal, mud, climatic and mixed health resorts. Balneal health resorts are often distinguished by the basic type of waters: carbonic, hydrosulphuric, radon, iodide-bromine, etc. It is also possible to distinguish health resorts mainly with internal intake of waters (drinking).

Ukraine has got many big and small health resorts (see Appendix 3).

Health resort establishments are subordinated to different authorities. The Ministry of Health of Ukraine has a network of antituberculosis and children's sanatoria of different profile (pathology of the locomotor apparatus, nervous system, respiratory organs, kidneys, etc.). The joint-stock company "Ukrprofzdravnitsa" has a plenty of sanatoria and boarding houses for treatment of nonspecific forms of diseases of adults, for family treatment. The specialization of these sanatoria depends, mainly, on leading natural medical factors at a concrete health resort. There are a lot of sanatoria and rest-homes in charge of the various ministries and some trade unions (social security, defense, agriculture and others), sanatoria-dispensaries; bases and camps of rest belonging mainly to concrete establishments and factories.

In many sanatoria of "Ukrprofzdravnitsa" there are various rehabilitation units: postinsult, postinfarction, posttraumatic ones, for burn and other patients, for pregnant women with genital and extragenital pathology, etc.

Indications and contraindications to treatment at health resorts are given in the Appendix 2. However, to make it simpler, it is possible to say that patients suffering from diseases and traumas of the locomotor, nervous

systems as well as diseases of sexual organs (in particular, at gynecology departments and sanatoria) are treated and rehabilitated at mud health resorts. Patients suffering from diseases of the organs of respiration, neurosis, neurocirculatory dystonia are mainly treated at climatic health resorts. "Drinking" health resorts are for patients with diseases of the organs of digestion, kidneys and urinary tract. Hydrosulphuric health resorts are basically indicated for patients with a cardiovascular pathology (including diseases of the peripheral vessels), diseases of the autonomic and peripheral nervous systems, the locomotor apparatus and the skin. Radon health resorts are generally indicated for treatment of pathology of the osteomuscular system and peripheral nerves. Carbonic waters are administered outwardly and inwardly in diseases of the organs of digestion, nervous and cardiovascular systems.

### 1.1.2. Attributes of physiotherapy

**The subject** of the study of physiotherapy are *therapeutic physical factors (currents, fields, irradiations, mineral waters, climate, therapeutic mud)* — the physical form of motion of the matter, which determines the therapeutic nature of the influence on different organs and systems of the organism.

**The object** of the study of physiotherapy is *a person* subjected to the influence of physical factors with therapeutic, preventive and health-improving purposes. The results of this influence can be evaluated both directly in the course of the procedure and indirectly by the extrapolation of the experiment data, carried out on animals, or with the aid of the mathematical modeling of therapeutic physical influence on the organism.

**The method** of physiotherapy is dialectical materialistic. It is a base for the scientific knowledge and during the combination of the morphofunctional methods of the investigation of the influence of therapeutic physical factors on the tissue with the clinical methods of evaluating the state of patients suffering from different diseases. The evaluation of the results obtained is accomplished with the aid of the methods of dialectical logic — analysis, synthesis, abstracting, induction, deduction, formalization and others.

### 1.1.3. Categories of physiotherapy

A group of the objects, united by the generality of origin (physical form of motion of the matter), composes **the categories of physiotherapy** — "therapeutic physical factor", "physical method of treatment", "a procedure of physiotherapeutic procedure".

*Therapeutic physical factor* is a physical form of motion of the matter, which determines the therapeutic nature of the influence on different organs and systems of the organism.

*Physical method of treatment* is totality of the methods of application of a concrete therapeutic physical factor.

*Procedure of physiotherapeutic procedure* is totality of the methods (operations) of the practical use of a concrete physical method of treatment.

The category "factor" (lat. *factor* — making, producing) is related to the cause, the factor, phenomenon that determines the character or its separate features. Physical factor is a constituent, a basis of the conceptual apparatus of physiotherapy and assumes the cause or factor, and it is determined by the physical form of motion of the matter. The adjective "therapeutic" specifies that the result of this action, caused by this cause (factor), is the effect, which has therapeutic (useful) value for the organism.

### 1.1.4. Laws of physiotherapy

**1. The law of the heterogeneity of physiotherapy:** heteromodal therapeutic physical factors have different receiving structures ("targets"), the molecular, cellular and systemic mechanisms of the therapeutic influence.

**2. The law (rule) of intensity:** high intensity physical factors exert unspecific influence, and low-intensity ones have specific influence on the organs and tissues of a patient.

**3. The law of specificity:** the specific influence of the therapeutic physical factor on the specific organs and tissues is caused by high selectivity of the sensitive biological structures (molecules, organoids, protein receptors and others) to this factor which starts the reactions of free energy emission in the cells.

The classifications *of therapeutic physical factors* are of different origin and designation. Scientific classifications are developed by different scientific schools, on their principles and arguments, and they are the object of active discussion on the pages of scientific journals.

## 1.2. A list of Physical Medical Agents and Methods. Electrotherapeutic Factors and Methods

### 1.2.1. Electric currents and methods of their application

1. The galvanic current* is galvanization (galvanotherapy).

2. Impulse-electric currents (constant and alternative) of low and average frequency:

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* Electric currents of constant direction (continuous and impulse) are used for electrophoresis with medicinal substances.

— diadynamic — diadynamic therapy;
— sinusoidal-modulated — amplipulse therapy;
— interference — stimulus therapy;
— short impulsive — interference-therapy;
— point — TENS-therapy;
— fluctuation — electropuncture;
— d'arsonval currents — fluctuation therapy;
— currents of electrosleep apparatus and LENARs — local d'arsonvalization;
— electrosleep therapy;
— transcranial (cerebral) electroanalgesia;
— currents of apparatus of mesodiencephalic modulation (MDM) — MDM-therapy;

3. Variable sinusoidal currents of average frequency (22–34 kHz):
— a current of suprasonic frequency — ultrasonic therapy;
— highsonic currents — highsonic electrotherapy.

4. Alternating current of high frequency (1.56mHz)* — diathermy.

5. Alternating current of ultrahigh friquency (UHF) (27,12 mHz) — cauterization of tissues (UHF — coagulation).

### 1.2.2. Electric, electromagnetic and magnetic fields and methods of their application

1. Constant electric field of high voltage (40–50 kW)** — franklinization.

2. Low-frequency impulse electric field of low voltage (20–80 Hz) — infita therapy.

3. Constant magnetic field of low voltage — magnetotherapy.

4. Variable low-frequency magnetic field (50–1000 Hz) — magnetotherapy.

5. Variable magnetic field of high frequency (13.56 mHz) — inductothermy.

6. Variable magnetic field of ultrahigh frequency (27–40 mHz) — UHF-inductothermy.

7. Variable electric field of ultrahigh frequency (27–40 mHz) — UHF-therapy.

8. Variable electromagnetic field of superhigh frequency (SHF), decimetre (460–490mHz) — decimetre microwave therapy — (DMT).

* Diathermic current is applied in surgery (diathermocoagulation of vessels, ulcers, papillomas, etc.)

** It is also applied for franklinophoresis with medicinal substances.

9. Variable electromagnetic field of SHF, centimetric (2375–2450 mHz) — centimetric microwave therapy (ÑÌÂ).

10. Variable electromagnetic field of the extremely high frequency (EHF), millimetric (57-65 GHz) — EHF-therapy

### 1.2.3. Aeroions and aerosols

1. Aerosols — aerosol therapy.
   1a. Aerosols of stone table salt — galotherapy.
2. Aerosols with an electric charge — electroaerosoltherapy.
3. Dry aeroions of air — aeroionotherapy.
4. Wet aeroions of air — hydroaeroionotherapy.

### 1.2.4. Medical factors and methods of preformed air usage

1. Air gas mixture (AGM) with decreased content of oxygen (10–12%) — normobaric hypoxytherapy.

2. Inhalation of oxygen (100%) under normal pressure — oxygenotherapy.

3. AGM with the increased contents of oxygen (95–97%) and carbon dioxide (3–5%) — carbogen — carbogenic therapy.

4. Gas mixture with the increased content of oxygen (30–40%) and helium (60–70%) — oxyheliotherapy.

5. Air under the decreased barometric pressure (up to 490 mm Hg) — hypobarotherapy.

6. Air under the increased barometric pressure (14% of oxygen, 86% of nitrogen) — hyperbarotherapy.

7. Air under changing barometric pressure — vacuum barotherapy.

8. Air enriched with oxygen (30–100%) under the increased atmospheric pressure — oxygen barotherapy.

9. Ozone oxygen mixture — ozone therapy.

10. The activated oxygen — singlet oxygen therapy.

### 1.2.5. Light rays and methods of their application

1. Infrared rays — thermophototherapy.
2. Visible rays — chromotherapy.
3. Ultraviolet rays — UV-therapy.
4. Laser rays — laser therapy.
5. Polarized rays (red, infra-red, etc.) — piler-therapy.

### 1.2.6. Mechanical medical factors and methods of their application

1. Mechanical influence on the tissue, manual and apparatus — massage, vibrotherapy, vibromassage.
2. Vibration — phonotherapy.
3. A heard sound — ultrasonic therapy.
4. Ultrasound — (ultraphonotherapy).
5. Mechanical manual influence on the spine, muscles and joints — manual therapy.
6. Traction of the spine and joints — medical distraction.
7. Point action by needles — acupuncture.
8. Point action by sticks and fingers (pressure) — acupressure.
9. Oscillation of the atmospheric pressure in various apparatus — barotherapy and baropressure (vacuum barotherapy).
10. Trainers and special mechanical apparatuses — mechanotherapy.
11. Applicators of Kuznetsov, Lyapko.
12. Fixing (immobilizing) corsets, girdles, collars, correcting dressings.

### 1.2.7. Thermal and cold medical factors and methods (thermotherapy)

1. Parrafin — paraffin therapy.
2. Ozokerite — ozokerite therapy.
3. Clay — clay therapy.
4. Naphthalanum — naphthalanum therapy.
5. Sand (warm and hot) — psammotherapy.
6. Cold (temperature of the tissues above 0ºC) — medical hypothermia.
7. Cold (with freezing) — cryotherapy, cryosurgery.
8. Heating pad.
9. A rubber pack with water of different temperature or with ice.

### 1.2.8. Medical muds (peloidotherapy)

1. Silt sulphidic mud (mud of salty ponds) peloid therapy.
2. Peat mud.
3. Silt mud of fresh ponds (sapropels).
4. Pseudovulcanic, vulcanic mud.

### 1.2.9. Waters and methods of their medical application

1. Fresh sweet waters — hydrotherapy.
2. Mineral water — balneotherapy.
3. Radon waters and steam — radon therapy.
4. Activated waters (fresh and mineral).
5. Medicinal waters (in baths).

### 1.2.10. Climatic medical factors and methods of their application

1. Fresh air — aerotherapy.
2. Solar rays — heliotherapy.
3. Factors of the sea — thalassotherapy.
4. Climates of the big geographical zones — climatotherapy.
5. Microclimate of caves, grottoes, special devices — microclimatotherapy (including speleotherapy, halotherapy, etc.).

Each factor (method) can be applied in the form of many techniques including peculiarities of the factor action, a site of application, force of influence, its duration, frequency of procedures, duration of treatment course, etc.

We should not forget about possibilities of home physiotherapy, and it is rather substantial:

— portable (pocket) electrostimulators;

— magnetotherapeutic capsules, pins, rings, bracelets, girdles, magnetoelasts, magnetic sand, etc.;

— apparatuses of aeroion-, hydroaeroion — and aerosol therapy;

— apparatuses for chromophototherapy: desktop sollux, infrarouge; for UV-therapy: portable lasers, apparatuses of piler therapy;

— apparatuses for vibrotherapy;

— sets of devices for acupressure;

— medical cups;

— devices for traction of the spine;

— house trainers;

— fixing corsets, girdles, collars, and the so-called radiculitis corsets (girdles), correctors of the posture;

— paraffin, ozokerite, sand, clay, rubber packs for hot or cold water, heating packs;

— Lyapko's and Kuznetsov's applicators;

— compresses with medical mud;

— baths and douches from fresh sweet water of different temperature;

— medicinal baths: turpentine, manganic, soda, oxygen, iodide-bromine, hydrosulphuric, from decoctions and tinctures of various plants, starch, etc.;
— baths prepared by means of table and sea salts;
— drinking of fresh sweet water with the medical purpose;
— bottle drinking medical and table waters;
— air baths.

It is possible to carry out various aspects of massage and self-massage in the home conditions. It is possible to carry out physiopuncture and manual therapy with the help of specialists at home.

## 1.3. General Principles of Physiotherapy

1. A principle of totality of mechanisms of action of natural and preformed physical medical agents: solar and artificial light, natural and artificial microwaves, natural and artificial magnets, natural and artificial activated fresh and mineral water, etc.

2. A principle of unity of preventive and therapeutic use of physical factors (many agents of physiotherapy are used in secondary and tertiary prophylaxis of various diseases).

3. A principle of unity of the physical, physical and chemical, chemical and psychotherapeutic parts of physiotherapeutic agents action mechanisms.

Many methods of physiotherapy are not obligatory physical: electro-, ultraphonophoresis with mineral water, medical mud, remedies, drinking of mineral water, hydrosulphuric, carbonic, iodide-bromine and other baths, medicinal inhalations, etc. According to the literature data, about 30% of medical effect of physical procedures is associated with suggestion and self-suggestion that, in particular, proves to be true by experiments with placebo-physiotherapy. All specified parts of the mechanism of action cooperate and supplement each other.

4. A principle of many-sided nature, comprehensiveness of physical therapy. It is applied in all areas of medicine, including tuberculosis and oncology. Physical factors can be applied at all stages of diseases — in the acute, subacute, chronic and rehabilitation periods. Only correct technique and dosage is important.

5. A reflex principle. In physiotherapy much is connected with the reflex chain reactions developing in an organism, in tissues and organs in response to application of the physical factor. Physical procedures are often a stimulus (stimuli) here influencing the mechanism of sanogenesis. Certainly, the leading part is played here by the central and autonomic nervous system. The resonant phenomena manifested in rhythmic influence can be related to it.

6. A principle of dialectic unity of the specific and nonspecific parts of the mechanism of action of physical medical agents. Each physical factor having independent value in medicine, possesses some specificity of the mechanism of action allowing to prefer it in this or that form of a pathology, otherwise it is expelled by others. At the same time, many factors possess the nonspecific thermal and mechanical effects increasing in intensification of a dose (influence energy) and thus surpassing the specific parts of the mechanism of action.

7. A principle of primary efficacy of unstable, including impulse physical effects. It is known from physiology and electrophysiology that nervous and other systems of an organism adapt rapidly enough to stable, monotonous, especially weak influences — responses decrease and disappear and accordingly there is a medical effect in physiotherapy.

8. A principle of adequate application of physical influences varying in strength: very weak (information), weak, of moderate strength and strong. This principle is excellently proved in fundamental researches by L. H. Garkavi, E. B. Kvakina and M. A. Ukolova. A practical principle of choosing optimum dosages is based on it. Enormous global experience of physiotherapy gives evidence of expediency of differentiated use of influences of different strength depending on the condition, age of a patient and peculiarities of the disease development.

9. A principle of repeatability of application of physical (physical and chemical) preventive and medical influences. This principle plays a special role in physical prophylaxis where maintenance of health level demands regular constant (or in the form of periodic courses) application of cool and cold waters, air baths, ultra-violet radiations, physical exercises, etc.

10. A principle of compatibility of physical medical factors with others, with medicines, psycho-, kinesi-, phyto-, pharmacotherapy. This principle is a basic one for practical efficacy of complex therapy, and in medical rehabilitation.

## 1.4. Mechanisms of Physiological and Medical Action of Physical Factors

The organism response to physiotherapeutic influences can be mainly local, at a distance, from a site of influence (reflex, within the limits of segments, etc.) and general.

There are temporary physiotherapeutic (physiopathic) responses (in balneology — balneal responses), developing more often after the first 2–3 procedures and disappearing rapidly enough — in 2–4 days after adaptation

response: neurasthenic, vegetovascular, dermoallergic, glenomuscular, dyspeptic, temperature, exacerbation of the disease, hematological. They can be subclinical, mild, of moderate severity and severe. Overwhelming majority of patients is observed to have the first two alternatives. The expression and character of responses depend on the initial state of an organism and its organs, on the stage of disease, site and area of influence (biologically active points, sections and zones), on its intensity and duration, specific properties of physical factors, rhythm of alternation and repeatability of procedures.

The following can occur in tissues in physical procedures: change (increase or decrease) of blood flow, penetrability of tissues, intensity of metabolism, muscular tonus, excitability of the nervous elements, and intensity of formation of biologically active materials. Physical factors can have desensitizing, antiseptic effect. They can destroy stones in the kidneys, the gall-bladder and the urinary bladder; eradicate fine papillomas, hematomas, warts etc. Physical factors can change excitability of structures of the brain and spinal cord (for example, in electrosleep), influence glands of the internal secretion, on the whole changing vital activity of many systems of an organism.

In some pathological processes it is enough to give one procedure for receiving medical effect (a hot bath in cholelithic or urolithic colic, hyperthermia in sauna in acute upper respiratory infection, manipulations on the spine in painful syndromes, etc.). However, the course of treatment consisting of many procedures is often insufficient in the rehabilitation period, after diseases and traumas, in chronic pathology. In these cases treatment is often complex, including 2–3 different influences. There may be combined only physical procedures, physical procedures with ET, massage, medicines and psychotherapy (see Appendix 1).

Physical medical factors (PMF) can be applied counting upon ***especially local medical effect***: treatment of ulcers, wounds, local inflammatory and other processes; in diseases of the skin, mucosa, eye, ear, throat, nose, joints, etc.

PMF can be administered locally to a healthy tissue to receive reflex ***medical effect at the distance***. For example: warming of the left arm improves coronary blood flow, it can relax or eliminate the attack of angina pectoris.

Physiotherapeutic procedures can be aimed at ***the central nervous system, the head or the spinal cord*** (electrosleep, influence by microwaves or EF of UHF, etc.) counting upon ***somatic medical effect***. In particular, electrosleep is indicated in bronchial asthma, peptic ulcer of the stomach, oblit-

erating endarteritis, hypertonic and ischemic disease of the heart, etc. At the same time PMFs are effective in many diseases of the brain: in neurosis, cerebrovascular pathology, aftereffects of the brain injuries and encephalitis.

Methods ***of physical medical influence on the glands of internal secretion*** are being developed and applied: the adrenals, the thyroid, the thymus, the sexual glands, etc. One of the examples is the following: adrenals are radiated by microwaves in systemic chronic inflammatory processes.

UV-rays and lasers are applied for ***direct influence on the blood***, in particular, in some forms of ischemic heart disease. The UV-irradiation of the blood is also carried out in septic conditions.

Besides, there are many ***general physiotherapeutic influences***: general water and air baths, general franklinization, d'arsonvalization, galvanization, etc.

## 1.5. Methods of Etiopathogenetic and Symptomatic Physiotherapy*

### 1.5.1. Methods of primary influence on the central nervous system:

— electrosleep and amplipulse-electrosleep;
— central electroanalgesia;
— electrophoresis with psychotropic agents (transcerebral);
— general franklinization;
— galvanization of the brain;
— d'arsonvalization of the head;
— influence of EF of UHF on the head and spinal cord;
— cool and cold hydrotherapeutic procedures (including wet wrappings);
— stream douches;
— carbonic baths;
— iodide-bromine baths.

### 1.5.2. Methods of primary influence on the peripheral nervous system and muscles:

— electrical stimulation of the peripheral nerves and muscles by impulse currents;

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* The transformed materials of the book by G. N. Ponomarenko "Physical methods of treatment" (1999) are used in this section.

— local d'arsonvalization;
— magnetostimulation;
— turpentine baths;
— classical massage;
— acupressure;
— medicinal electrophoresis with neurotropic specimens;
— low-frequency vibrotherapy (10–100 Hz).

### 1.5.3. Methods of primary influence on the cardiovascular system

***Hypotensive and spasmolytic methods:***

— oxygen baths;
— hydrosulphuric baths;
— sea baths (including artificial);
— warm fresh baths;
— general franklinization;
— inductothermy of the kidneys and extremities;
— microwave therapy;
— light baths;
— infra-red radiation;
— medicinal electrophoresis with vasodilators;
— magnetotherapy.

***Vasoconstrictive methods:***

— cold and cool hydrotherapeutic procedures;
— carbonic baths (after a short-term dilatation of the vessels their long contraction develops);
— local d'arsonvalization;
— electrophoresis with vasoconstrictive medicines.

### 1.5.4. Methods of influence on the organs of respiration:

— UV-radiation of the skin of the chest, neck, soles and mucosa;
— laser therapy;
— intraorganic electrophoresis with medicinal substances;
— inhalations of medicinal substances (broncholytics, mucolytics, etc.);
— aeroionotherapy (hydroaeroionotherapy);
— haloaerosol therapy;
— oxygen heliotherapy.

### 1.5.5. Methods of influence on the gastrointestinal tract

***Methods stimulating the stomach secretory function**:*

— chloride sodium-calcium potable water;

— carbonic potable water;

— mud applications in the area of the abdomen.

***Methods relaxing the stomach secretory function:***

— sodium hydrogen carbonate potable water;

— sulfate sodium-magnesium potable water;

— inductothermy;

— microwaves;

— hydrosulphuric baths.

***Methods increasing the intestine motility function:***

— electrical stimulation of the intestine;

— hypertonic enemas;

— intestinal lavages with medical waters with high concentration of salts;

— sulphatic, sodium-magnesium water with moderate and high concentration of salts;

— drinking of cool and cold medical mineral water.

***Methods increasing bile production and biliary excretion:***

— chloride-sulphatic sodium-magnesium potable water;

— mud applications on the liver area;

— warm influence on the liver and gall-bladder (warm baths, inductothermy, microwaves, ozokerite, paraffin, etc.)

### 1.5.6. Methods of influence on the skin and mucosa:

— UV-radiations;

— PUVA-therapy;

— heliotherapy;

— IR-radiation;

— local and general franklinization;

— aeroiono- and hydroaeroionotherapy;

— medicinal electrophoresis with various specimens;

— astringent and enveloping baths: with chamomile tinctures, bur-marigold, decoctions of the oak bark, leaves of walnut trees, starch, etc.;

— steam baths, baths and douches;

— keratolytic baths and small baths with soda;

— small baths and baths with a solution of potassium permanganate;
— medical mud;
— ozokerite and paraffin applications.

### 1.5.7. Methods of influence on the endocrine system

***Influencing the adrenals:***
— low intensity inductothermy;
— low intensity DMW-therapy;
***Influencing the thyroid gland:***
— low intensity CMW (weakly thermal doses up to 40 Wt in distant methods and in contact (3–5 Wt).

***Influencing the thymus:***
— low intensity CMW and DMW-therapy (in weakness of the immune system);
***Influencing the hypothalamus-pituitary system:***
— transcerebral UHF-therapy (27.12 mHz).

***Influencing the pancreas:***
— thermal procedures in sparing regimens (in chronic pancreatitis and diabetes mellitus) on the spinal projection of the pancreas (paraffin, ozokerite, warm semi-baths, light heat, sand);
— impulse currents in anesthetizing regimens (in chronic or subacute pains).

### 1.5.8. Analgesic methods:

— transcranial electroanalgesia;
— local application of impulse currents;
— impulse magnetotherapy;
— vibrotherapy (frequency of 80–200 Hz);
— acupuncture, physiopuncture;
— weakly and moderately erythemal UV-therapy (MUV);
— cold and heat;
— manual therapy, massage;
— traction of the spine and joints (in osteochondrosis of the spine and osteoarthrosis);
— radiation therapy;
— electro- and phonophoresis with analgesics and anesthetics;
— Kuznetsov's and Lyapko's applicators.

### 1.5.9. Anti-inflammatory methods

***Alternative-exudate phase (sparing therapy):***

— low intensity UHF-therapy;

— medicinal electrophoresis with silver preparations, antibiotics, sulfanilamides, antirheumatic remedies (intraorganic electrophoresis);

— medicinal phonophoresis with interferon, lidase, antibiotics, etc.;

— local d'arsonvalization;

— hypothermia (cryotherapy);

— local franklinization.

***Proliferative phase (infiltration-proliferation):***

— UHF-therapy of moderate intensity (moderate thermal doses);

— DMW-therapy of moderate intensity;

— CMW-therapy of moderate intensity;

— inhalations of corticosteroids;

— ultraphonophoresis with hydrocortisone;

— inductothermy and microwave influence on the adrenal area;

— low-frequency magnetotherapy;

— red laser therapy;

— turpentine baths;

— sauna.

***Reparative phase:***

— inductothermy of moderate intensity;

— microwave therapy of moderate intensity;

— electrophoresis with lidase;

— paraffin therapy

— ozokerite therapy;

— pelotherapy;

— infrared laser therapy;

— ultrasonic therapy, ultraphonophoresis with lidase;

— hydrosulphuric, radon baths.

### 1.5.10. Antibacterial, antiviral, antimycotic methods:

— UV-radiation (integrated and SUV methods);

— local franklinization;

— local electrophoresis with zincum (2% solution in fungal diseases);

— inhalations of interferon;

— local ultraphonophoresis with interferon;

— endonasal electrophoresis with antiviral preparations;

— intraorganic electrophoresis with antibiotics;

— electrophoresis with silver preparations (nasal, in the oral cavity);
— baths and small baths with potassium manganese;
— ultraviolet irradiation of blood.

### 1.5.11. Methods of influence on immunity and nonspecific resistance of an organism

***Methods of immunomodulation:***

— suberythemal and weakly erythemal radiations (general and segmentary);
— dosed heliotherapy;
— thalassotherapy;
— physiopuncture (SWF, laser, acupuncture, etc.);
— ultra-violet radiations of blood;
— laser radiation of blood;
— normobaric hypoxytherapy;
— inhalations of immunomodulators (0.5% solution of lysozyme, 0.01% solution of levamisole, 0.2% and 0.4% solution of prodigiosane, ginseng tincture, eleuterococcus, aloe extract (0.025–0.5 ml for inhalation), 1% solution of sodium nucleinate (0.4 g for one procedure).

***Methods of immune suppression:***

— cryotherapy in special chambers (-20... -120°C Kryosanna, Kryostan);
— cold wet wrappings;
— physiopuncture;
— controlled general hypothermia (hypothermia of the head);
— electrophoresis with hydrocortisone, prednisolone.

### 1.5.12. Antiallergic (desensitizing) methods:

— course of LUV-therapy (apparatus of Psorilux type);
— dosed heliotherapy;
— aluminous baths;
— baths from decoctions of the oak bark, leaves of walnuts;
— starch baths;
— speleo (halo)-therapy;
— sulphidic and radon baths;
— aeroion- and hydroaeroion therapy;
— medicinal inhalations (intal, tiled, glucocorticoids);
— medicinal electrophoresis with antihistamine remedies (Dimedrol, Suprastin, Pipolphen, etc.);
— ultraphonophoresis.

### 1.5.13. Trophotropic methods (improvement of circulation, metabolism processes and tissue regeneration):

— photothermotherapy (light baths, sollux);
— magnetotherapy;
— local barotherapy, hyperbaroxytherapy;
— ultrasonic therapy and local darsonvalization;
— inductothermy, microwave therapy;
— water-thermal procedures
— sauna, steam bath;
— hydrosulphuric baths ($H_2S$ up to 150 mg/l);
— drinking of medical mineral waters;
— electrosleep;
— UHF-influence on the hypothalamic area;
— air therapy (treatment by the fresh and activated air);
— singlet-oxygen therapy;
— carboxytherapy (inhalations of oxygen and carbonic acid mixture);
— hypothermal local procedures;
— ozokerite and paraffin therapy;
— pelotherapy;
— electrical stimulation of the neuromuscular apparatus;
— aeroion-, hydroiontherapy; mono- and bipolar;
— electrophoresis with vitamins $B_1$, E, $B_{12}$;
— massage, hydromassage, vibrotherapy;
— electrophoresis with vessel-regulating agents.

### 1.5.14. Methods promoting resorption of nonpurulent infiltrates, fresh cicatrices and adhesions:

— ultrasonic therapy;
— ultraphonophoresis with lidase;
— electrophoresis with lidase;
— paraffin and ozokerite therapy;
— pelotherapy;
— local thermal procedures (light, heating pad, thermal heater, etc.);
— massage and vibromassage.

### 1.5.15. Destructive physiotherapy (including physiosurgery):

— diathermocoagulation of tissues;
— local d'arsonvalization in a destructive regimen;

— UHF-coagulation (UHF currents);
— high-intensive laser therapy;
— cryolysis;
— focused ultrasonic destruction of the tissues;
— strong and hypererythemal UV-radiation;
— photodestruction of bilirubin by dark blue light.

## 1.6. Main Principles of Medical Application of Physical Factors

**A principle of continuity of application of physical medical agents**

Before administration of physical factors the doctor is obliged to imagine precisely what medical actions the patient had been administered before, how he had tolerated them and what was the result of treatment.

While administrating electroprocedures, it is important to know their tolerance by the patients. There is intolerance to electric current, ultrasound, hydrosulphuric baths, etc.

The principle of continuity can provide medication for further physio-, balneotherapy, for example, in cases of the chronic inflammatory foci in an organism.

The specified principle is observed when it is necessary to recommend repeated or other courses of physiotherapy after one course of treatment.

**A principle of early administration of physical medical agents (PMA)**

PMA can be administered in the acute period, at the very beginning of some diseases and traumas: cold on the head — in concussion or contusion of the brain; electrical stimulation of the intestine — in development of its paresis; impulse currents — in acute painful syndromes; EF of UHF — in acute inflammatory processes; medical cups — in acute pneumonia; a warm or hot bath — in an attack of cholelithic disease. This principle means timely administration of the physical factor in lingering processes.

**A principle of adequate, individual administration of physical medical agents (a principle of individualization of physiotherapy)**

Techniques of carrying out one or several various physical procedures should correspond to adaptation abilities of the tissue, organ, system or an organism on the whole, peculiarity of development of the disease, its phase. The principle also provides methodical features of carrying out PhT in children, persons of elderly and senile age (geriatric PhT), in weakened patients, in serious diseases and traumas.

**A principle of use of specific properties of physical medical agents**

Each medical physical factor has a unique mechanism of action which allows to receive maximal therapeutic effect. The ultrasound, for example, possesses a pronounced resorption action in infiltrates, fresh cicatrices and adhesions. Electric field of UHF renders distinct anti-inflammatory action on fresh purulent foci deep in the tissues. Hydrosulphuric baths with increasing concentration of hydrogen sulfide from 100 up to 400 mg/l improve peripheral circulation in the tissues. Any other agent of PhT does not give similar activation of blood microcirculation. Cold water and air procedures above all stimulate systems of the immune protection of an organism. Undoubtedly, there is a certain interchangeability of physical factors in PhT; however, while choosing them for the concrete patient it is necessary to prefer those which mechanism of medical action is maximally adequate to peculiarities of the disease.

**A principle of administration of optimal dosages**

In physiotherapy there are four variants of dosages by strength and duration of the influence: very weak (informative), weak, moderate and strong. Depending on adaptation abilities of a sick organism, character of the disease, phase of its development, and acuteness of the process one variant of the dose is chosen. During the treatment course dosage of procedures may change: weak doses gradually turn into moderate, strong ones may be weakened, etc.

Weak anesthetizing dosages of physical factor are usually chosen in strong acute painful syndromes. High or moderate doses of physical factors (PhF) give the best results in long-term chronic disease. Sparing influences of PhF are expedient in people of elderly and senile age, children, and weakened patients as well as in the acute periods of diseases and traumas.

Between principles of optimal dosages and individualization of therapy there is a close interrelation as a choice of optimum parameters of procedures for the concrete patient is always individual.

**A principle of integrated approach of physiotherapy**

Complex therapy of many chronic polyetiological diseases is always more effective than monotherapy as it provides polysystemic influences on different parts of the pathological process. Of special interest is a combination of general and local PT procedures. The general procedures exert mainly normalizing influence on functioning of different systems of an organism (nervous, cardiovascular, endocrine, immune, etc.) and through them — on the course of local pathological process. Local procedures in much greater degree influence its focal manifestations (local circulation, permeability of

tissues, phagocytosis, development of biologically active substances, tissue regeneration, etc.).

The complex can be composed for treatment of one or several diseases in one person. Danger of failure of tissues and organism adaptation increases in this case. The medical complex can consist only of physical factors; it is often observed in sanatorium conditions, or it may include physiotherapeutic exercises, massage, psychotherapy, medicines, etc.

**A principle of dynamism of physiotherapy**

One of the frequent disadvantages of work of many doctors, especially doctors of resort establishments is stability of parameters of the medical complex during therapy.

Patients have different tolerance to the same electro-, balneo-, peloid procedures. During treatment there can develop moderate and severe physiobalneoreactions and phase changes of the organism condition can be observed. Besides, according to fundamental researches of L. H. Garkavi, E. B. Kvakina and M. A. Ukolova weak dosages of physical influences should be strengthened gradually during the course of treatment, moderate ones should be changed wave-like, and strong ones weakened.

Thus, within the course it is necessary to make changes in dosages and structure of the medical complex. Correction of dosages of physical procedures is provided by changes of water temperature, strength of the electric current or intensity of ultrasound, the area of influence, duration, alternation of procedures and so forth on the basis of the additional data received during the course of treatment. In some cases it is possible to change parameters of influence within one procedure.

**A principle of taking into consideration biological rhythms**

As there are conditionally called momentary, daily, monthly, yearly and other periodic changes of intensity of various functions of an organism, they should be taken into consideration in administration of PhT. There is physiotherapeutic equipment based on application of the data of the momentary rhythms of the cardiac activity (apparatus “Sincardon”, Spilt’s barochambers), biological currents of the muscles (apparatuses “Myoton”, “Myocor”, etc.), rhythms of electroencephalograms (some models of the apparatuses of electrosleep). It is recommended to administer physiotherapeutic procedures taking into account daily rhythms: tonic ones are better to be given in the first half of the day, sedative — in the second, electrosleep — is more expedient in the middle of the day, electrophoresis depending on the remedy — at a different daytime. Physical factors can be included in prophylactic complexes of seasonal exacerbations of diseases.

**A principle of psychotherapeutic potentiation of physical procedures**

It is known that while carrying out treatment the considerable role for the patient is played by suggestion, auto-suggestion. Behaviour of the medical is of considerable importance (30–40%). No doubt, disorder in the room, negligent attitude, indifference, roughness of the personnel negatively affects treatment. And on the contrary, cleanliness, neatness, order, politeness, the benevolent attitude of physicians to patients increase efficacy of PhT application. The high estimation of the administered physical procedures by the medical personnel and confirmation of their utility is important. It is expedient to tell patients about possibility of unpleasant sensations, temporary exacerbation of the disease, mainly at the beginning of treatment, occurrence of physiobalneoreactions.

**A principle of preventive application of physiotherapy**

Such physical (physical and chemical) factors as air, UV-rays, aero- and hydroaeroions, sauna, fresh and mineral waters, general massage are widespread agents of primary physical prophylaxis. Tempering and improvement of people's health (both healthy and with weakened health) is carried out with their help.

Secondary physical prophylaxis is intended for improvement of persons with the family, household or professional risk factors promoting development of diseases. Besides the specified agents, the preventive measures may include electrosleep, cerebral (central) electroanesthesia, general franklinization, mechanoprophylaxis, local kinds of massage, inductothermy, electrophoresis with medicinal substances, etc.

Tertiary physioprophylaxis made for the prevention of relapses and progressing of various diseases uses all arsenals of physical medical and preventive agents.

## 1.7. Medical Rehabilitation

Establishments of medical rehabilitation occupy a big place in public health services of the developed countries. Economists consider that well organized rehabilitation treatment is not only effective from the point of view of medicine, but it is also profitable, let alone psychosocial effects. According to their data, one dollar invested into medical rehabilitation, gives 4–5 dollars of profit. We shouldn't forget about its primacy as it provides the subsequent professional and social rehabilitation. The statistics speaks that developed service of medical rehabilitation returns about 50% of patients to productive work.

### 1.7.1. The primary goals of medical rehabilitation

1. Restoration of the function of the damaged organs, systems and an organism on the whole.

2. Restoration of anatomical structures (plastic and restorative operations).

3. Restoration of adaptation abilities of an organism and its systems.

4. Restoration of the maximum nervous activity (mind) including the adequate attitude to a disease, work, surrounding people and medical personnel), attitude to oneself (in particular, elimination of the depressive and hypochondrial phenomena).

A system of medical rehabilitation was formed in domestic public health services: centres, hospitals and out-patient departments of rehabilitation treatment, there are departments and rooms available in various hospitals, polyclinics, dispensaries. There are departments and clinics of rehabilitation treatment in many research institutes. Departments of medical rehabilitation are created in establishments of postgraduate training of doctors and in medical universities.

The sanatorium system of the country has rehabilitation departments for postinfarction and postinsult patients, pregnant women, sanatoria for rehabilitation of patients with traumas of the spine and spinal cord, sanatoria for children with consequences of poliomyelitis, patients suffering from children's cerebral paralysis, children and adult patients with tuberculosis, in particular, tuberculosis of the bones and joints, for persons suffering from radiation after the Chernobyl accident, etc.

Physiatrists, doctors and methodologists of physiotherapy exercises, psychotherapists should be the basic employees of the departments of rehabilitation treatment in multiprofile hospitals and polyclinics. Depending on concrete conditions cardiologists, neuropathologists, orthopedists-traumatologists and other experts can be involved in their work.

It is possible to distinguish *four basic periods of rehabilitation treatment:* early, medium, late and supporting (dispensary). They are developed at different time and are of different duration for various diseases. First of them is carried out in hospital in the first weeks or months after a trauma or acute process. The second will be organized more often under conditions of a rehabilitation centre, polyclinic or sanatorium (for example, at the sanatorium stage of rehabilitation of postinfarction patients). The late period is final for active rehabilitation treatment and is carried out in many weeks and months after the first one. It can be given under different conditions, including active work at home. The supporting period may be prolonged for years, and the achieved medical effect is kept in it by means of various measures.

*The arsenal of agents of medical rehabilitation* is various. First of all they are different variants *of kinesitherapy:* passive movements, walking, running, swimming, physical exercises, simple and sports games, hydrokinesi-, mechano- and occupational therapy. Then agents and methods *of physiotherapy* comes*:* electrical stimulation of the neuromuscular apparatus, many kinds of thermal procedures, ultraviolet irradiations, medical muds, mineral and gas baths, climatic factors. We consider that it is very important to include complex agents and methods *of psychotherapy* in rehabilitation*:* auto- and heterotraining, rational psychotherapy, and if necessary hypnosis. In a number of fields of medicine surgical measures (of plastic, reconstructive type, etc.) with the subsequent conservative treatment can be performed as one of the kinds of rehabilitation treatment. The role of medicines decreases at the stage of rehabilitation treatment.

### 1.7.2. The basic groups of adult patients subjected to medical rehabilitation

Many patients require rehabilitation treatment, but we may distinguish the most important groups among them; material resources and methodical bases of rehabilitation are first of all created for them.

*The major groups of patients who are subject to rehabilitation in adults are the following:* postinfarction patients (up to 80% of them return to work, up to 90% of restoration of complete self-service), postinsult patients, patients with consequences of traumas of the head and spinal cord, spine and extremities. Special attention should be paid to development of the rehabilitation system of persons with consequences of fractures of the lower extremities, in particular, its resort stage since it promises great medical and economic benefit.

The patients who have undergone surgery on the heart and vessels, operations for tumours as well as a very big group of patients after operations on the digestive organs: after a resection of the stomach, intestine and gall-bladder require development of various forms of rehabilitation treatment.

There is a need for rehabilitation of patients with chronic diseases of respiratory organs and especially with chronic bronchitis quite often resulting in bronchial asthma. The importance of rehabilitation of patients with tuberculosis increases.

The issues of rehabilitation treatment of patients with neurosis and psychosis under conditions of psychoneurological dispensaries and their daytime hospitals are also important. Their value does not decrease taking into account the increase of psychotraumatic factors under the conditions of progressing urbanization.

### 1.7.3. The basic groups of children subjected to rehabilitation:

— children with consequences of birth trauma and disturbances of one or another function;

— children who had operations on the heart for congenital defects;

— children suffering from chronic diseases of the respiratory organs;

— children suffering from congenital or acquired diseases of the locomotor apparatus: scoliosis of the spine, congenital deformations and dislocations of the joints, polyarthritis and others;

— children suffering from tuberculosis.

### 1.7.4. Principles of medical rehabilitation:

— the early beginning, including the acute period of a disease or trauma in many cases;

— system, sequence, and continuity of rehabilitation;

— use of advanced achievements of science and technology;

— individualization of rehabilitation taking into consideration adaptation abilities of an organism and use of compensatory mechanisms;

— stages of rehabilitation in different variants: hospital — polyclinic — sanatorium, hospital — sanatorium — polyclinic, hospital — rehabilitation centre — sanatorium — polyclinic, etc;

— integrated approach of rehabilitation with inclusion of ET, agents of physiotherapy, psychotherapy, surgery (if necessary), medicines, diet, etc.;

— dynamism of using agents of rehabilitation depending on the achieved results at different stages;

— active participation of the patient (and his relatives) in rehabilitation treatment (a principle of partnership*);*

— achievement of the steady level of health (a principle of completeness);

— use of supporting measures after finishing a complex of rehabilitation (prophylactic medical examination during the residual phenomena).

## 1.8. Tendencies and Ways of Physiotherapy Development

The analysis of the modern state of physiotherapy allows to assert that in the 21st century it will remain one of the most attractive and dynamically developing fields of medicine. Despite the fact that the majority of therapeutic physical factors possess predominantly pathogenetic, but not etio-

tropic influence, they will be actively included in the schemes of treatment of patients with different diseases, since they have exceptional value for increasing the nonspecific resistance of the organism and restoration of the mechanisms of the regulation of its functions, whose disturbance is the basis of pathogenesis of the majority of diseases.

Among the new methodological approaches to the estimation of efficacy of the influence of therapeutic physical factors it is necessary to note the development of the concepts of the demonstrative and personalized physiotherapy.

*Demonstrative physiotherapy* is a section of physiotherapy associated with the application only of those physical methods in the treatment of patients whose efficacy is proven in high-quality studies. The methodology of demonstrative physiotherapy is based on the unification of the study protocols and conduction of the controlled clinical tests, which must meet *four basic requirements:* to have the comparative nature (a group of comparison or placebo); to be carried out at random choice of patients; to be randomized, to have an imitation of intervention; to evaluate the result according to the end points (patients' quality of life). The application of methods of demonstrative physiotherapy by practicing doctors includes the estimation of the proofs of scientific publications, search for the necessary proofs and their analysis before the application to the concrete patient (development of the plan of treatment).

*Personalized physiotherapy* is a section of personalized medicine based on administration of physical methods of treatment to the patient on the basis of the factors determining (limiting or substantially modulating) their therapeutic effects — determinant of their efficacy. It is shown that the causes for the dissociation of the therapeutic effects of physical factors are caused not only by the level of the base functions, disturbed in concrete patients, but also by the numerous clinical states associated with them, such as genetic polymorphism, disturbance of metabolism, affection of the target organs. Today attention of the clinicians is drawn to genetic polymorphism and the metabolic axis of the diseases, which are leading in prognosis and dictate the tactics of patients' management in accordance with the modern recommendations for the treatment of the basic nosologic forms of diseases.

Among the achievements in basic research of modern physiotherapy there should be noted the discovery of the phenomena of the genetic determination of mechanisms of the therapeutic effect of therapeutic physical factors (that makes the basis of its new section — physiogenetics) and their modulation of the functional properties of the mesenchymal stem cells, which initiated *physiomodified cellular therapy.*

In the last decade there is a real boom of physical therapy, which is caused by rapid scientific and technical progress in the field of electronics in the world, by development of nanotechnologies and by creation of the fundamentally new sources of different physical fields, which found their use in medicine too. Besides them, the new physical methods of treatment were introduced in physiotherapy in the recent decades; it required the cardinal revision of the contents of a number of its sections. Rapid technological changes and increase in the competition, which are caused by globalization of the technologies of physical medicine, require a constant increase in the level of its knowledge by specialists, which is impossible without the knowledge of the conceptual (basic) apparatus of their specialty.

## Control Questions

1. Give the determination of the term "physiotherapy".
2. Give the determination of the term "medical rehabilitation".
3. What basic groups of physical therapeutic methods do you know?
4. How, to what organs can physical therapeutic factors be administered?
5. Name the basic principles of the physical therapeutic methods application.
6. What is the structure of the departments of rehabilitation treatment, what specialists work there?
7. What basic groups of patients, adults and children, are subject to priority rehabilitation treatment, in particular in the specialized sanatoria?
8. Name the main health resorts of Ukraine and their therapeutic profile.
9. Who is sanatorium and spa treatment indicated first of all to?
10. Name the periods of medical rehabilitation.
11. Name the basic principles of medical rehabilitation.

## Control Tests

1. A health resort is:

A. The locality, which possesses a complete set of natural therapeutic resources (therapeutic climate, mineral waters, therapeutic mud)
B. The locality with presence of one of the natural therapeutic factors
C. The developed and utilized for therapeutic and prophylactic purposes, especially guarded natural territory having natural therapeutic resources and the objects of infrastructure necessary for their operation
D. The locality with the presence of therapeutic and prophylactic establishments — sanatoria, recreation centres, boarding houses
E. All enumerated

2. Mineral waters at the balneological health resorts are used:
A. Exclusively for the internal uses
B. Only for the external application
C. For the internal and external application
D. They are not used
E. In the complex with the artificial factors

3. The drug treatment in the sanatoria:
A. Is not given
B. Is given by medical indications
C. Is given only in case of aggravation of the disease
D. Is given fully
E. Only B and D

4. What patients are contraindicated to be treated at the health resort or in the local sanatorium?
A. With congenital defect of the heart, chronic insufficiency of the 1st stage.
B. Chronic nonspecific cystitis
C. Reflux-esophagitis
D. Blood disease in the phase of exacerbation
E. Chronic bronchitis

5. Name the general contraindication, which prevents the direction of the patient to the sanatorium:
A. Ischemic heart disease, exertional angina pectoris of the 2nd FC
B. Anemia
C. Epilepsy
D. Hypertension of the 2nd stage
E. Bronchial asthma

# *Chapter 2*
# ELECTROTHERAPY (USE OF ELECTRIC CURRENT, ELECTRIC, ELECTROMAGNETIC AND MAGNETIC FIELDS IN THE CLINICAL PRACTICE)

Electric currents have been used in medicine with the therapeutic purpose for more than 200 years. Various electromagnetic fields have been used for more than 100 years: general franklinization — since 1882, general d'arsonvalization — since 1892. Magnetic fields have been applied for about two thousand years. K. Galen wrote about them in the second century A.D. Some kinds of electromedical influences are rather new (TENS-, SWF-, MDM, Infita-therapy).

## 2.1. The Basic Methods of Electrotherapy*

### 2.1.1. Methods of application of constant electromagnetic currents (continuous and impulse)

**Galvanotherapy** is a medical influence (MI) by continuous constant electric current of little strength (up to 50 mA) and low tension (up to 80 W).

**Electrical stimulation** is a MI on the tissues and organs (mainly on the neuromuscular apparatus) by impulse currents of various form and frequency (1–160 Hz) for normalization of their functions.

**Diodynamotherapy** is a MI by rhythmic semi-sinusoidal currents with frequency of 50 and 100 Hz, transferred independently or in alternating among themselves with pauses.

**Electrosleep** is a MI on the head by rhythmic impulse rectangular currents of low frequency (more often from 5 up to 160 Hz, small strength — 2–8 mA and tension up to 50 W). **

* Methods of electrotherapy are carried out in the form of numerous techniques stated in instructions available in each apparatus. They are stated in special or fuller instructions.

** The equipment of electrosleep with other characteristics of current is occasionally applied.

**Cerebral (transcranial, central) electroanalgesia** is a MI on the head by rhythmic rectangular currents of low and average frequency (60–100 and 150–2000 Hz), current strength — up to 3–4 mA.

**Mesodiencephalic modulation (MDM)** is a MI on the head by highly specific rectangular impulse currents with frequency of 60–90 Hz, duration 4 mc, amplitude 1–5 mA with an additional constant component (ACC).

**TENS-therapy** — (short impulse electroanalgesia) is a MI on the tissues by rhythmic impulse (rectangular, sinusoidal sawtooth, bipolar and dissymmetric) currents of little strength and low frequency (2–200 Hz) for anesthesia.

### 2.1.2. Methods of application of constant and alternating electric currents

**Electropuncture** is a MI on biologically active points by weak currents (mono- and bipolar, current strength is from 100 mcA up to 1 mA) of low and moderate frequency (20–2000 Hz).

**Amplipulse therapy*** is a MI on the tissues and organs by sinusoidal currents of average frequency (2000-5000 Hz), the modulated frequencies (10–150 Hz), current strength is up to 10 mA. Nonrectified regimen is application of alternating current, and rectified — constant current.

**Highsonic therapy** is a MI by alternating modulated electric current in a frequency range from 4.096 up to 32.768 Hz, current strength is up to 10 mA.

**Interference-therapy** is a MI by crossed sinusoidal currents of average frequency (4000-5500 Hz).

**Fluctuation therapy** is a MI by peaked currents, spontaneously changing frequency and strength ("chaotic" — up to 3 mA) in a range from 100 up to 2000 Hz. They can move in regimens of constant and alternating currents.

**Ultrasonic therapy** is a MI by continuous alternating currents of suprasonic frequency (22 kHz), small strength (up to 3 mA).

**Local d'arsonvalization** is a MI by impulse alternating currents of high frequency (100–110 kHz, of little strength — up to 0.02 mA). Frequency of flashes (impulses) is 50–100 Hz and tension — 20–30 kW.

**Electrophoresis with medicinal substances** is a combined use of constant currents and medicines introduced by them into the tissue: galvano-, diodynamo-, electrosleep-, flucto-, amplipulse phoresis with medicinal substances.

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* Conditionally it may include application of medical currents from apparatus of a series "Stimul".

In electrophoresis with strong medicines and poisons their medical action prevails.

### 2.1.3. Methods of application of electric fields

**Franklinization (electrostatic douche)** is a general and local MI by constant electric field of high tension (up to 40 kW).

**Infita therapy** is a MI by impulse low frequency electromagnetic field on the central nervous system (20–80 Hz).

**UHF-therapy** — a MI by alternating electric field of ultrahigh frequency (27.12 and 40.68 MHz).

### 2.1.4. Methods of application of magnetic fields

**Constant magnetotherapy** is a MI by constant magnetic field. Value of magnetic induction is up to 100 mT.

**Low-frequency magnetotherapy** is a MI by alternating magnetic field of low frequency (more often about 50 Hz). Value of magnetic induction is up to 100 mT.

**Impulse magnetotherapy** is a MI by impulse magnetic field of low frequency (from 10 up to 150 Hz) and different strength (value of magnetic induction is from 10 mT up to 1.5 T).

**Inductothermy** is a MI by alternating magnetic field of high frequency (13.56 mHz), a wavelength is 22.13 m.

**UHF-inductothermy** is a MI by alternating magnetic field of ultrahigh frequency (27.12 and 40.68 mHz).

### 2.1.5. Methods of application of electromagnetic fields (irradiations)

**Decimetre wave therapy (DMW-therapy)** is a MI by electromagnetic waves of decimetre range (frequency is 430–460 mHz, a wavelength is 33–65 cm).

**Centimetre therapy (CMW)** is a MI by electromagnetic waves of centimetre range (frequency — 2375–2450 mHz, a wavelength is 12.5–12.4 cm).

**Extremely high-frequency therapy (EHF-therapy)** is a MI by electromagnetic waves of millimetre range (frequency of 42–65 GHz, length of waves is 7.1–5 mm).

In the literature the first two methods are often united by terms microwave or SHF-therapy.

Medicine of many countries widely applies impulse electric currents, magnetic and electric fields of UHF, microwaves, electrophoresis with medicinal substances and to a lesser extent various ways of magnetotherapy.

## 2.2. Mechanism of Action of Electroprocedures

There is movement of ions in the tissues under the influence of constant currents. Cations (ions +) move to the cathode, and anions (ions-) — to the anode. There is electrolysis of water and substances dissolved (ionization) in it. Under the electrodes of an opposite sign ions lose the charges and turn into elements possessing high chemical activity. Reaction of the medium changes: acids are formed under the anode, and alkalis are formed under the cathode. The chemical substances formed and the changed reaction of the medium essentially changes permeability of the tissues, course of biochemical reactions, and physiological and pathological processes.

There is a depression of permeability of the tissues, consolidation, weakening of excitability of the nervous receptors, fibres of the cells (anelectrotonus) under the anode and increased permeability, loosening of tissues, and enhanced excitability of the nervous elements (catelectrotonus) under the cathode. Under the electrodes there is formation of nosologically active substances (bradykinin, acetylcholine, histamine, etc.), the vasodilatation, and activation of metabolism. This is more expressed under the cathode. Regeneration of the tissues is also stimulated under it. Electroprocedures can activate phagocytosis, development of interferon and antibodies. When applied locally, currents can influence a functional condition of various organs and systems. There are mainly local reactions, segmentary-reflex, reactions at the distance and general. The expressiveness of the reaction depends on characteristics of currents (the form, strength, frequency of impulses), durations of procedures, areas and zones under the influence, rate of procedure administration, and duration of the course of treatment.

Impulse currents of low frequency (20–50 Hz) have mainly irritating effect and are used for electrical stimulation of the muscles — electrogymnastics. Impulse currents of higher frequency (100–200 Hz and higher) are more often applied to suppression of painful sensitivity, and electroanalgesia.

In shortened duration of current impulses up to 0.1–0.4 ms and little current strength (5–30 mA) only the analgetic effect is given — TENS-therapy. The form of impulses is also important. Peaked and rectangular impulse currents possess greater irritating influence on the tissue than wave and exponential ones.

Impulse currents of higher frequency (2000–5500 Hz) get into the tissues deeper than continuous or currents of low frequency (with other conditions being equal). They possess a greater anesthetizing action.

A special role is played by electrosleep, mesodiencephalic electromodulation and cerebral electroanalgesia in which the electric current gets inside the cerebral cavity, influencing various structures of the brain. Alongside with sedative, spasmolytic, analgesic influence central trophotropic effects develop here, allowing to apply the specified methods in many nervous, internal, dermal, surgical and other diseases.

The mechanism of action of electropuncture is first of all associated with general notions about acupuncture. However, parameters of the applied currents play a considerable role here: the form of impulses, their frequency, current strength, duration of procedures, etc. Special literature is available on this theme.

**Medical effects of electric currents:** analgesic, sedative, irritating (at the cathode), anti-inflammatory, stimulating (at low frequency of impulses), secretory (at the cathode), thermal.

## 2.3. Medicinal Electrophoresis

Medicinal electrophoresis is a medical method of combined actions of current and a drug introduced by it into the tissue. It is widely applied in various fields of medicine. From 5 up to 10% of the substance being in a medicinal solution on linings is introduced into tissues. The amount of the introduced substance depends on the condition of the skin or mucosa, degree of dissociation of the substance in the solution, size of its molecules (large-molecular compounds are introduced worse), character of electric current (more in galvanophoresis, but deeper in amplipulse phoresis), current strength and duration of the procedure. Hundreds of the medicinal substances are known to be applied with electrophoresis, most often administered substances are presented in the table 1.

It is necessary to take into consideration basic qualities of medicinal substances while choosing constant current for electrophoresis. So, it is necessary to apply currents with the pronounced anesthetizing action for electrophoresis with analgesics and anesthetics, and currents with irritating effect used for electrical stimulation of the neuromuscular apparatus for electrophoresis with proserin-like preparations.

It is necessary to choose correctly a pole from which the medicine (see table 1) is introduced. In absence of precise data the medicine can be introduced from two poles. Complex, multicomponent preparations as well as mud solutions are, as a rule, introduced from two poles.

Table 1. **Pharmaceutical substances often used for electrophoresis**

| The substance used | Concentration of solution or number of substances on procedure | Polarity |
|---|---|---|
| Adrenalin hydrochloride | 0.1% 0.5–1ml | +/– |
| The liquid extract of aloe, juice of aloe | 1:3 | +/– |
| Aminazin | 1% | + |
| Analgin | 2–5% (water);<br>5–10% in 25% | –<br>+/– |
| Propranolol | 0.5%, 5 ml | + |
| Ascorbic acid | 2–5% | – |
| Atropine sulfate | 0.1% ml | + |
| Acetylsalicylic acid | 5–10% in 50% | – |
| Acetylcholine hydrochloride | 0.1–0.5% | + |
| Barbital sodium | 3–5% | – |
| Benzohexamethonium | 1–2% | + |
| Sodium bromide | 2–5% | – |
| Thiamine bromide | 2% | + |
| Cyanocobalamin | 0.1–0.2 mg | + |
| Tocopherol acetate | 2% in 5%, 0.5 ml | + |
| Methyl methionine sulfonium chloride | 1% | + |
| Haloperidol | 0.5% | + |
| Gangleron | 0.25–0.5% | + |
| Heparin sodium salt | 5,000–10,000 | – |
| Hyaluronidase | 0.1–0.2 g on 30 ml of distilled water acidified to pH=5.0–5.2 | + |
| Hydrocortisone succinate (water–soluble) | 1 ampoule is dissolved in 0.2% solution of hydrocarbonate sodium or water alkalized to pH = 9.0 | – |
| Histamine dehydrochloride | 0.1% (to 1ml) | + |
| Glutaminic acid | 0.5–2% in alkalized distilled water to pH=7.8–8.0 | – |
| Therapeutic mud | solution | +/– |

*Continuation of table 1*

| The substance used | Concentration of solution or number of substances on procedure | Polarity |
|---|---|---|
| Dibasol | 0.5–2% | + |
| Tetracaine | 0.5–1% | + |
| Diphenhydramine hydrochloride | 0.25–1% | + |
| Potassium (sodium) iodide | 2–5% | – |
| Cavinton | 1 ml (5 mg) of ampullaceous solution (0.5%) is diluted in 1 ml | + |
| Potassium iodide | 2–5% | +/– |
| Calcium chloride | 2–5% | + |
| Potassium chloride | 2–5% | + |
| Caffeine-benzoate sodium 1% in 5% solution of sodium hydrocarbonate | 1–2% | +/– |
| Xycain (Lidocaine) | 0.5–1% | + |
| Lydase | 0.1 g (64 IU) on 30 ml of the acidified water with pH=5.2 | + |
| Lithium benzoate (chloride) | 2–5% | + |
| Magnesium sulfate | 2–5% | + |
| Manganese sulfate | 2–5% | + |
| Copper sulfate | 0.1–5% | + |
| Mesaton | 1–2% | + |
| Sodium chloride | 2–5% | + |
| Nicotine acid | 0.5–1% | – |
| Nitroglycerine | 0.5 ml of 1% alcoholic solution + 99.5 ml of distilled water (single dose 5–10 ml of the indicated solution) | + |
| Novocaine hydrochloride | 0.25–5% | + |
| No-spa | 1–2% | + |
| Obzidan | 0.1%, 5ml | + |
| Papaverine hydrochloride | 0.1–0.5% | + |
| Sodium paraminosalycilate | 1–2% | – |
| Peloidine | — | +/– |
| Pentamin | 5% | + |

*End of table 1*

| The substance used | Concentration of solution or number of substances on procedure | Polarity |
|---|---|---|
| Pilocarpine hydrochloride | 0.1–0.5% | + |
| Platyphyllin hydrotartate | 0.05–0.1% | + |
| Prednisolone (soluble) | 0.5% | + |
| Proserin | 0.1% | + |
| Propolis | 2–5% | +/– |
| Ronidase | 0.5 g is dissolved in 30 ml of acetate buffet solution or acidified distilled water | + |
| Seduxen | 0.5%, 2 ml | + |
| Ichthyol Unithiol | 10–30%, 2–5% | – |
| Silver nitrate | 0.5–1% | + |
| Serotonin adipinate | 1%, 1ml | + |
| Cincocaine hydrochloride | 0.25–1% | + |
| Theophyllin | 2–5% on alkalized water (pH=8.5–8,7) | – |
| Trimecaine | 0.5–2% | + |
| Fencarol | 0.5% in 25% solution | + |
| Sodium phosphate | 2–5% | – |
| Sodium fluoride | 2% | – |
| Quinine hydrochloride | 1% | + |
| Sodium chloride | 2–5% | – |
| Zinc sulfate | 0.5–1% | + |
| Aminophylline | 2–5% | +/– |
| Ephedrine hydrochloride | 0.1–1% | + |
| Vipraxine | 1ml | +/– |
| Apisatrone | 0.01–0.1% | +/– |

In mechanisms of action of electric magnetic high-frequency and electromagnetic fields thermal and anti-inflammatory components are added or intensified. The latter is especially pronounced in application of electric field of HF of UHF for the processes developing inside the tissues, and the electric field of franklinization administered locally is rather effective in treatment of sluggish wounds and dermal ulcers. Electric field of UHF and decimetre microwaves in hyperthermal dosage may damage and destroy tissues; it allows to apply them in complex therapy of oncological diseases.

Sedative, vasodilating, antiedematous and central trophotropic effects may be manifested while influencing the brain by various fields.

*The basic medical effects of electric electromagnetic and magnetic (HF and UHF) fields:* thermal, spasmolytic, vasodilating, anesthetizing, sedative, anti-inflammatory, immunomodulating, trophotropic, etc.

## 2.4. Indications and Contraindications to Application. Apparatuses

Different kinds of currents and fields have one or another primary use.

**The galvanic current** is more often applied to one of the kinds of *electrophoresis* with medicinal substances — *galvanophoresis.* In its turn galvanophoresis with medicines (up to 300 names) is used in many diseases:

— *diseases of the nervous system:* neurosis, disturbance of the cerebral circulation, a consequence of traumas of the head and spinal cord, encephalitis and myelitis, diseases of the autonomic and peripheral nervous system, their trauma;

— *diseases of internal organs:* chronic bronchitis, pneumonia, idiopathic hypertension, ischemic heart disease, gastritis and gastroenteritis, ulcer of the stomach and duodenum, chronic pancreatitis, etc.;

— *diseases of the locomotor apparatus:* arthritis, arthrosis, polyarthritis, osteoarthrosis, osteochondrosis of the spine, myalgia, myositis, tendovaginitis, consequences of traumas of the muscles, bones and joints;

— *gynecological and urological diseases:* vaginitis and vulvovaginitis-, peri- and parametritis, adnexitis, prostatitis, etc.

**Galvanophoresis with medicinal substances** is used in practice of specialized physiotherapeutic rooms for treatment of the eyes, aural, dermal diseases, in odontology and even in phthisiology. It should be understood that galvanophoresis is a combined medical action of galvanic current and medicinal substances, introduced by it into the tissues.

***Apparatuses:*** Potok-1 and -2, Microtok, GR-2, Physiotron, AGVK-4, Meta, Neuroton, Endomed, a hydrogalvanic bath, BTL-05, MIT-11 (Fig. 1, 2).

**Electrosleep** (and electrosleepphoresis with MI) is widely applied in the clinical course of the nervous diseases, mainly, in neurosis and neurosis-like conditions, in initial forms of cerebral vascular disturbance; *in therapy* (ischemic heart disease, bronchial asthma, peptic ulcer of the stomach and duodenum, idiopathic hypertension, obliterating endarteritis), *in psychiatry* (reactive conditions, mild forms of psychosis).

*Fig. 1.* Galvanization unit BTL-5000

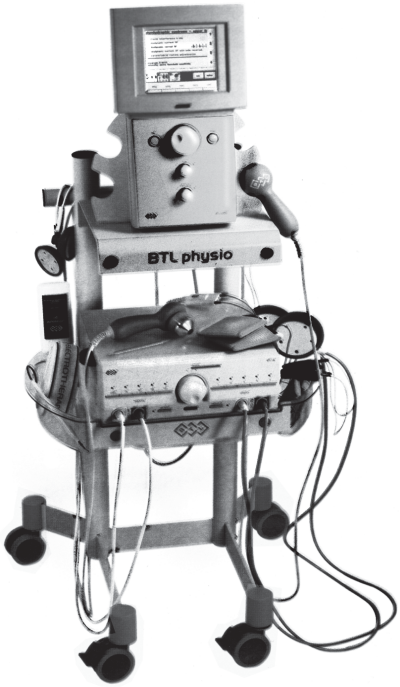


Fig. 2. Electro-, lasero, UV-therapy unit BTL-5000 Combi

***Apparatuses:*** Electrosleep-4T (ES-4T), Electrosleep-5 (ES-10-B), Meta.

**The cerebral (transcranial) electroanalgesia** is applied to struggle against various painful syndromes, in treatment of ischemic heart disease, neurocirculatory dystonia, peptic ulcer of the stomach and duodenum, neurosis, pruritic dermatosis and other diseases.

***Apparatuses:*** LENAR and Bi-LENAR , Entrans-1, -2, -3, Transair, Meta.

**Mesodiencephalic modulation** is indicated to patients in neurosis and neurosis-like heart conditions, disturbances of sleep, endocrine dysfunctions, bronchial asthma, ischemic disease, exertional angina I, II FC, neurosthenia, fatiguability and acute alcoholic abstinence, dyscirculatory encephalopathy.

***Apparatuses:*** MDM-1, MDM-101, -103, -201.

**TENS-therapy** is a method of treatment of various painful syndromes, mainly of superficial localization. One of the advantages is portability of the equipment and opportunity of its use in any conditions.

***Apparatuses:*** EPB-60-01, Delta-101, Delta-102, Neurone, Impulse, Electronica-ChENS-2, Endomed, Tenscaro, Staodyn, Biotonus, Eliman, etc.

**Diadynamo-, amplipulse- and interference-therapy** are applied, mainly, in treatment of superficial and deep painful syndromes as well as for electrogymnastics of the paret-

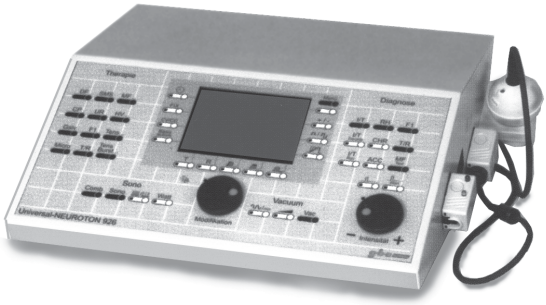

*Fig. 3.* Physiotherapeutic unit Universal Neuroton-926

ic muscles. Methods of amplipulse and interference-therapies can be used on the head for procedures of electrosleep. In these cases they have the same indications as electrosleep.

*Apparatuses of diadynamotherapy:* SNIM-1, Tonus-1, Tonus-2, Biopulsator, Diodinamac DD-5A, Dinamed, Diadinamic, Neuroton, Endomed.

*Apparatuses of amplipulse therapy: Amplipulse*-4, -5 and -6.

*Apparatuses of interference therapy:* AIT-01, AIT-50-2, Interenferencepulse, Interdyn, Nemectrodin, Stereodynator, Duodynator (Fig. 3).

**High tone therapy** is administered mainly for control of numerous painful syndromes and electrical stimulation of the muscles.

Besides, it is indicated in Bekhterev's disease, osteochondrosis of the spine, osteoporosis, osteoarthrosis of I and II stages, epicondylitis and periarthritis, obesity.

***Apparatuses:*** HiTOP-184, HiTOP-182, HiTOP-181, HiTOP-172 (Body Beauty), HiTOP-142 (PowerStim) (Fig. 4).

**Electrogymnastics of the muscles** can be carried out by means of specialized apparatuses: Myorithm, Myoton, Stimul-1, Stimul-2, Neuropulse, Neurostat, Neurosan-50, Myodin, Minidin, Tonus-1, Tonus-2, Neuron-1, MIT-1c, AEST-01.

**Stimulation of muscles of the stomach and intestine** is carried out by the apparatuses: Endoton-1 and Endomed. There are apparatuses for stimulation of the urethral and anal sphincters.

**Stimulation of muscles of the diaphragm** is made by the apparatus ESD-2P.

**Fluctuation therapy** is used in the dental practice, in facial and dental pains, inflammatory processes (including fluctophoresis with analgesics) as well as in the clinical course of nervous diseases, in head and cervical pains.

***Apparatuses:*** ASB-2-G, FS-100 (for odontology).

**Ultratone therapy** is especially useful in the children's practice due to small irritating action of STF currents, in diseases of the skin and mucosa,

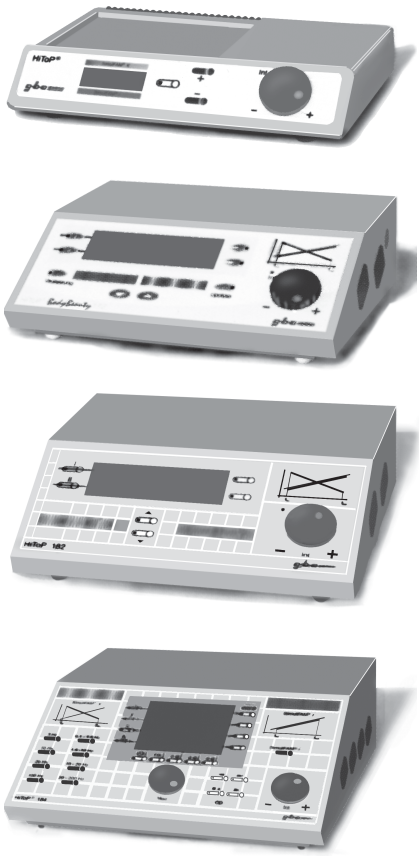

*Fig 4.* High tone therapy units Hitop-184, -182, -181, -172 (Body Beauty)

peripheral nervous system, in badly healing wounds and ulcers. This method is applied infrequently in adults in dermal, female and nervous diseases of mainly inflammatory character (nonpurulent).

***Apparatuses:*** Ultraton (ATNCh-1 and-2), Ultraton APM.

**Local d'arsonvalization** is more often used in children of senior groups and in adults in treatment of neurosis, uracrasia, neurocirculatory dystonia (cardialgia), varicose phlebectasia of the extremities and hemorrhoidal veins, diseases of the oral cavity, dermatosis, alopecia, and inflammatory diseases of female sexual organs.

***Apparatuses:*** Iskra-1 and -2, Korona, Impulse-1.

**Franklinization.** General franklinization is used in treatment of hypersthenic forms of neurosis and neurosis-like conditions, idiopathic hypertension and neurocirculatory dystonia (the hypertensive form). Local franklinization is administered mainly in treatment of badly healing wounds and ulcers.

***Apparatuses:*** AF-3-1, FA-5-3.

**Infita therapy** is indicated to patients with cerebrovascular pathology, rehabilitation after cerebral insults, hypertension disease, osteochondrosis, patients with neurosis and neurosis-like disturbances.

***Apparatus:*** Infita.

The electric field of UHF is the most effective in therapy of local acute and subacute inflammatory processes in deep tissues. EF of UHF may be administered in athermal, oligothermal, thermal and hyperthermal regimens. In the first two variants it is applied to influence local inflammatory processes (including purulent) mainly in the acute and subacute stages. In the third regimen it can be administered for treatment of chronic inflammatory

diseases, in traumas of the tissues, as antispasmodic in the peripheral ischemic syndromes. The hyperthermal regimen is used in oncology, in complex therapy of cancerous tumours.

In treatment of suppurative foci it is necessarily to combine EF of UHF with application of antibacterial medicines.

***Apparatuses:*** UVCh-52 (Minitherm), UVCh-30, UVCh-50 (Ustye), UVCh-66, UVCh-80 (Undatherm), Ekran-2, UVCh-Impulse-3 (apparatus is resulted by way of increase of a power output), Ultratherm.

**Inductothermy and UHF-inductothermy** is carried out by heating of the tissues predominantly with weak and medium-thermal dosages (oligothermal and thermal). They promote resorption of infiltrates, fresh cicatrices and adhesions; render local trophotropic and anti-inflammatory action. They are successfully applied in subacute and chronic nonpurulent diseases of internal organs, the locomotor apparatus, the peripheral nervous systems and spinal cord, female sexual organs, ENT-organs, maxillodental system (UHF-inductothermy). UHF-inductothermy is intended basically for procedures on the head.

***Apparatuses:*** Thermo-500, IKV-4, Phyaction (Fig. 5, 6). Procedures of UHF-inductothermy are made on apparatuses of the electric field of UHF by means of the inductors EVT-1, in diameter of 6.9 and 14 cm.

*Fig. 5.* Short wave thermotherapy unit Thermatur-200

*Fig. 6.* Short wave therapy unit Thermo-500

*Fig. 7.* Microwave thermotherapy unit Thermatur m250

**Microwave therapy** exerts mainly thermal local medical influence, but general medical effects develop in irradiation of the glands of internal secretion and the central nervous system. Decimetre waves get into the tissues at the depth of up to 9–11 cm and centimetre — up to 7–8 cm. Depending on intensity of influence (dosages) of a microwave it can exert local weakening or stimulating influence on processes of immunogenesis and neogenesis in the irradiated tissues. The indications are the same as for inductothermy.

***Apparatuses*** for decimeter therapy (tabletop): DMV-15 Romashka and DMV-20-1 Ranet; mobile with a high power output Volna-2M (up to 100 W).

***Apparatuses*** for centimeter therapy *(tabletop)*: SMV-20-3, Luch-3-1, SMV-20-4, Luch-4; *stationary:* SMV-150-1, Luch-11, Luch-58, Thermika, Endotherm, Curadar, Radarmed, Radiotherm, Thermotur (Fig. 7).

Now methods of UV-therapy are used mainly in the form of influence on biologically active points. Depth of penetration of millimetric waves into the tissue is 1–2 mm.

***Medical effects:*** neurostimulating, trophic, local analgesic, secretory, immunostimulating, sedative.

***Basic indications:*** subacute and chronic inflammatory diseases of the peripheral nervous system, organs of respiration, skin, diseases of the locomotor apparatus, peptic ulcer of the stomach and duodenum, depression of organism reactivity.

***Contraindications:*** pigmentary spots, nevuses, angiomas, bronchial asthma, vegetalgia, neurodermitis.

***Apparatuses:*** Yav-1, Elektronika KVCh-101, Initiacia-2MT, Shlem-01, Porog-1, Kvoter, Resonans, MAVI, MIT-1.

**Magnetotherapy** is carried out by constant magnetic fields of low-frequency impulse and alternating. Impulse and alternating magnetic fields are considered to be more effective. The medical effect depends on strength of the field — sizes of magnetic induction, duration of procedures and course of treatment.

Magnetic fields in medical dosages change excitability of the nervous system, peripheral blood flow, permeability of the tissues, lower arterial pressure. Depth of penetration into the tissues is 6 cm.

***Medical effects:*** analgesic, antiedematous, vasoactive, hypotensive, hypocoagulating, trophotropic, sedative.

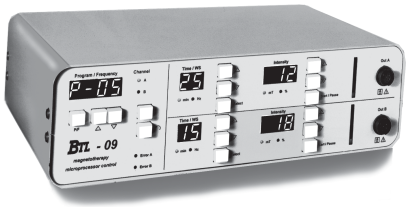


*Fig. 8.* Magnetotherapeutic unit BTL-09

***Basic indications:*** consequences of traumas of the locomotor and nervous system, degenerate-dystrophic diseases of the bones and joints: osteochondrosis, osteoarthrosis, arthritis, periarthritis, tendovaginitis as well as diseases of the peripheral nervous system.

***Basic contraindications:*** pronounced hyperthyroidism, ischemic heart disease with frequent attacks of angina pectoris, pronounced hypotension, acute thrombophlebitis, malignant neoplasms.

*Fig. 9.* Applicators for BTL-09

***Apparatuses:*** ring magnets (MKM2-1), disk (MDM2-2), applicators (ALM), Biomag AVIMP, Polus-1, -2, -3, -4, Magniter, MAG-30, Polus-101, ALIMP-G, AMIT-01, Mavr, Malakhit, MIT-11, BTL-09 (Fig. 8, 9).

The apparatus of the certain series has their own features of magnetic fields, work and techniques of application.

**General contraindications to electrotherapy:**

— intolerance to current and field;

— malignant neoplasms;

— sepsis and suppurative foci (EF of UHF application is permitted on single suppurative foci);

— feverish conditions;

— clotting disease;

— fresh myocardial infarction;

— frequent attacks of angina pectoris;

— cardiovascular, respiratory, renal, hepatic failure in the stage of decompensation;

— fractures of bones up to a steady immobilization of fragments (for electric currents);

— for local procedures contraindications are pregnancy, implanted cardiostimulators, benign tumours, fresh insult;

— hemorrhagic syndrome;

— cachexia.

Duration of the majority of the procedures which are carried out by electric currents ranges from 5 up to 30 min (depending on current type, age of the patient and character of the disease). But in some cases it reaches 60 min and more: electrosleep, highsonic therapy, central electroanalgesia, etc. Procedures can be given once a day, once in 2 days and even 2–3 times a day (for example, in TENS-therapy, magnetotherapy).

The course of treatment may have from 2–3 up to 20 procedures. Duration of the procedures which are carried out by fields is on an average 15–20 min. Weak magnetotherapeutic influences can last for many hours. Procedures are administered daily or in a day up to 20 procedures for the course. In some diseases the course of treatment can be longer. For example, in surgical tuberculosis the number of EF of UHF procedures in thermal or oligothermal dosages can reach 40–50 (for one course).

## 2.5. The Aid at a Lesion Caused by Electric Current

In physiotherapeutic rooms a lesion caused by electric current can occur due to malfunction of the equipment or because of disturbance of safety precaution regulations.

The patient can receive an electrotrauma if he touches the earthed metal object: a pipe of heating or waterpipe, radiator, the body of the physiotherapeutic apparatus, etc. during electroprocedure. The medical personnel can suffer, in particular, owing to malfunction in the electric system.

In lesions caused by electric current there may be disturbances of the cardiovascular, respiratory and nervous systems: loss of consciousness, arrhythmia, cyanosis, cramps, traces of combustion on the skin. Clinical death may occur.

Actions of the medical personnel:

— disconnect electric current immediately;

— in disturbances of respiration — artificial ventilation of the lungs by means of special apparatus or respiration by the mouth — to mouth method is possible;

— in disturbances of the cardiac activity and respiration give 1% solution of lobeline on 1.0 mm 2 times, intravenously or intramusculary 0.1% the solution of adrenaline 1.0 subcutaneously, and make a cardiac massage. It is expedient to give 5–10 ml of 10% solution of calcium chloride intravenously;

— call in the resuscitation ambulance.

Then they enter intravenously 200 ml of 2% solution of sodium bicarbonate. With grave condition such injections are repeated every 10–15 min till the circulation restors.

In severe cyanosis it is possible to make blood-letting with subsequent injection of glucose and saline solution.

All the specified measures should be taken before arrival of the ambulance.

**Control Questions**

1. What is galvanization?
2. What is electrophoresis with medicinal substances? Name its main types.
3. Explain the method of cerebral electroanalgesia? Name the main apparatus.
4. Name the main types of electrostimulation.
5. What is meant by the term intracutaneous electroneurostimulation (IENS) (short pulse therapy)? What is it used for?
6. What is microwave therapy, what apparatuses do you know?
7. What is meant by the term magnetotherapy?
8. What are indications for applying electrosleep?
9. In what groups of syndromes are diadynamo-, amplipulse and interference therapy used?
10. In what diseases are inductothermy and microwave therapy administered?
11. At what periods of the inflammatory processes is electric field of UHF effective?
12. What is meant by the term SHF therapy? What is the main direction of its application?
13. What is the mechanism of effect of factors of electromagnetic nature?

14. What is thermal and oscillatory effect of factors of electromagnetic nature?

15. Name the main rules of giving factors of electromagnetic nature.

16. Name indications, contraindications and age limitations for administration of factors of electromagnetic nature (UHF, inductothermy, centimeter and decimeter wave therapy).

## Control Tests

1. In what form is it possible to introduce medicinal substances in the organism by constant current?

A. Ionized
B. Molecular
C. Dipole
D. Atomic
E. Aerozol

2. Electrophoresis with drugs is a method of the combined effect of medicinal substance and:

A. Alternating current
B. Pulse current
C. Direct continuous current
D. Interference currents
E. Magnetic field

3. What is the optimum concentration of solution for the majority of medicinal substances while giving electrophoresis with drugs?

A. Up to 5%
B. 5–10%
C. 10–20%
D. 20–30%
E. Over 30%

4. UHF-therapy is not indicated at the same day with:

A. Balneotherapy
B. Peloidotherapy
C. Electrophoresis with drugs
D. Therapeutic massage
E. Superhigh frequency therapy

5. What biophysical mechanisms the therapeutic influence of the decimeter waves is realized through?

A. Conduction current

B. Oscillatory fluctuation of the dipoles of the bound water

C. Electrolysis

D. Formation of bioradicals

E. Polarization of the membranes

*Chapter 3*

# PHOTOTHERAPY (APPLICATION OF INFRARED, VISIBLE, ULTRAVIOLET, LASER AND POLARIZED RAYS)

Solar rays (heliotherapy) are applied with the medical purpose from time immemorial. Application of artificial light for treatment of patients has a little more than centenary history. Medical application of UV-rays first of all in therapy of skin tuberculosis (N. R. Finzon) and electrolight baths for thermotherapy started in the middle of the 80s of the 19th century. A little bit later there were widely known lamps Sollux, Minin's, Infrarouge, etc. The technology of lamps of UV-radiations also developed. At the end of the 60s of the 20th century laser therapy (in physiotherapy — low-intensity laser treatment) began to be applied. Since the 80s polarized light — pilertherapy has been used.

## 3.1. Peculiarities of Light Rays

Light is electromagnetic fluctuations of environment in the range from 1000 microns (1 mm) up to 2 nanometers*. They possess properties of particles (quanta, photons) and waves. Quantum is a part of radiation energy, inversely proportional to length of the wave. In light spectrum short ultra-violet rays possess the greatest number of quanta; the spectrum of light rays consists of three basic parts:

— infrared (IR) rays occupy from 780 nm up to 1000 microns;

— visible rays — from 400 nm up to 780 nm;

— ultraviolet (UV) rays — from 2 nm up to 400 nm.

In all three optical ranges there were created sources of artificial laser beams. Laser radiation is monochromal (rigidly fixed length of the wave), and coherent (an identical phase of radiation for all fluctuations); it is polarized (has fixed orientation of vectors of the electromagnetic field in space).

* Nanometre is one milliard part of a metre.

All this provides small divergence and high orientation of a laser ray (LR). Physiotherapy basically applies low intensity lasers in infra-red and red ranges, in continuous and pulse modes. LR is used for point influence, intravenous irradiation of blood; and the defocused ray is used for influence on the skin areas and mucous membranes in the diameter up to 30 cm. Density of the stream of energy makes 5–10 mWt/cm$^2$.

Piler-light is artificial polarized, not coherent polychromatic light (length of the wave is 400–2000 nm).

Each part of a light spectrum is also divided into three parts: long-wave (A), middle wave (B) and short-wave (C), this division is essential for UV-therapy as clinical application of long ultraviolet rays (LUV) essentially differs from that of short ones (SUV). Lengths of the waves in devices are as follows: LUV — 320–400 nm, MUV — 280–320 nm, SUV — 180–280 nm.

There are cold (luminescence) and hot luminescence. There are four main kinds of cold luminescence:

— chemoluminescence — luminescence arising due to chemical (biochemical reactions);

— triboluminescence — luminescence developing under the influence of mechanical influences (friction);

— photoluminescence — luminescence manifested under or after light influences;

— electroluminescence — luminescence of bodies (gases) in passing of an electric current through them.

In interaction of light with the skin of the person the part of optical radiation is reflected, the other part is absorbed. The coefficient of reflection of weakly pigmented skin reaches 50–55% (for perpendicular rays). In increasing the angle of ray fall it can be elevated up to 90%. The pigmented dark skin absorbs rays to a greater extent than the light one.

## 3.2. The Mechanism of Action of Light Rays on Biological Objects

In absorption of light by living organisms the following basic reactions can develop in them:

1) **photosynthesis** — formation of complex organic molecules (an example — synthesis of vitamin D in the skin);

2) **photolysis** — destruction of organic compounds and living cells (an example — processes in the skin under erythemal influence of UV-rays) with formation of biologically active substances;

3) **photoreception** — development of neuroreflex responses in various receptor systems: in the skin, mucous membranes and in the eye retina. A particular kind of photoreception is **photoinformation** coming almost exclusively through the eye;

4) **photoheating** — rise in temperature of the tissues under the influence of light beams;

5) **photoelectrization** — occurrence of weak electric currents in the tissues.

**IR-rays** getting through the skin and mucous membranes at the depth up to 4–5 cm, exert mainly thermal influence (thermal rays). **Visible rays** exert weak thermal, information, photochemical influence and weak photoelectric (depth of penetration is 1.5–3 cm). **UV-beams** exert weak thermal, pronounced photochemical (photosynthesis and photolysis) and photo-electric influence. It is UV-rays especially in a short range that can damage nuclear substance of cells and their genetic apparatus (depth of penetration into the tissues is 0.1–0.6 mm).

In absorption of laser radiation by the tissues of an organism its coherence and polarization disappear at the depth of 0.2–0.3 mm though the rays reach the depth of 6–7 cm.

**Piler-light** gets into the tissues at the depth of 1.5–2.5 cm, having weak thermal and photochemical effect.

## 3.3. The Mechanism of Medical Action of Light Rays (Administration of Therapeutic Doses)

**IR rays** exert mainly thermal influence on the tissue that causes:

— intensification of the blood circulation in the skin and internal organs (especially in a corresponding splanchnotome) as a result of transfer of heat by blood and reflex responses;

— increase of permeability of the tissues;

— activation of metabolism;

— dissolution of infiltrates, fresh cicatrices and adhesions;

— stimulation of regeneration;

— antispastic effect;

— anesthesia and sedative action (in oligothermal thermal doses);

— reduction of the increased arterial pressure;

— drying up of the skin (wet ulcers, eczema);

— sudorific effect with detoxication of an organism;

— reduction of activity of thermolabile microorganisms.

***Medical effects:*** vasoactive, trophotropic, drying up, analgesic, spasmolytic, immunocorrective.

**Visible beams** possess the following mechanisms of action:

— action exciting the nervous system in bright illumination or by red (orange) light;

— antidepressive (pink colour, increased illumination);

— calming, sedative effect — green, blue rays;

— depression — black light;

— dark blue and blue beams destroy bilirubin of blood (they are applied in hyperbilirubinemia of newborns and hereditary hyperbilirubinemia);

— rhythmic weak light flashes at frequencies of 5–12 Hz exert a sedative influence, and at frequencies of 20–40 Hz — an exciting one;

— thermal effects.

***Medical effects:*** psychoemotional (antidepressive), central and peripheral trophotropic, vasoactive, immunomodulating, photolytic (bilirubin), sedative.

UV-rays in therapeutic dosage influence biochemical and physiological processes in the tissues:

— photolysis and formation of biologically active substances;

— photosynthesis (vitamin D and melanin);

— activation of phagocytosis, developments of interferon, antibodies;

— stimulation of blood circulation;

— anesthesia;

— activation of the blood circulation;

— increase of permeability of the tissues;

— stimulation of metabolism and processes of regeneration of the tissues;

— bactericidal effect;

— normalization of blood circulation;

— antitoxic action;

— stimulation of development of the connecting tissue;

— desensitizing effect (in the course of application of UV-rays).

***Medical effects:*** anti-inflammatory, desensitizing, trophotropic, vitamin-forming, bactericidal, immunostimulating, analgesic.

## 3.4. The Mechanism of Action of Low-Intensity Laser Irradiation on the Tissues

The laser beam getting deep into the tissues influences atoms, selectively molecules, nervous receptors and cellular structures (the effect of photobioactivation).

It results in improvement of microcirculation, permeability of the tissues increases, metabolic processes are activated, peroxide oxidation of lipids is suppressed, and all these processes can promote abatement of aseptic inflammatory process and dissolution of infiltrates. The laser irradiation reduces to some extent tactile and painful sensitivity in the area of influence. It stimulates mechanisms of local and general immune system of an organism. LR suppresses living functions of microorganisms. The influence on the superficial tissues develops reflex segmental and general responses that, in particular, are used in puncture laser reflexotherapy.

In laser irradiation of blood activation of the ferment erythrocyte systems occurs, resulting in increase in oxygen capacity of blood. The indurable procedures of blood irradiation (up to 30 min) result in reduction of thrombocyte aggregation velocity and contents of fibrinogen, increase of the level of free heparin and fibrinolytic activity of blood serum.

***Medical effects:*** metabolic, improving microcirculation, analgesic, immunomodulating, anticoagulating, desensitizing.

**The polarized rays** of infra-red and visible range possess trophotropic, immunomodulating, analgesic, desensitizing, and antispastic effects.

## 3.5. Indications and Contraindications to Phototherapy

### Indication to application of infrared and visible beams:

— acute, subacute and chronic painful syndromes and inflammatory processes: neuralgia, neuropathies, radiculopathies, myalgias, myositis, rhinitis, etc.

— a trauma of the tissues (from the 2nd–3rd day);

— arthrosis, arthritis, polyarthritis;

— unhealing wounds and ulcers;

— fresh cicatrices and adhesions;

— peripheral ischemic syndromes, including obliterating diseases;

— hyperbilirubinemia of newborns and hereditary-familial hyperbilirubinemia;

— neurosis and neurosis-like conditions, depressions (treatment by bright light).

### Indications to application of UV-rays:

— preventive, general sanitary action in adults and children (anti-rickets);

— preoperative preparation of patients (suberythemal and weakly erythemal doses);

— diseases of the peripheral nervous system;
— initial manifestations of cerebral atherosclerosis;
— neurosis and neurosis-like conditions;
— diseases of the locomotor apparatus: osteochondrosis of the spine, osteoarthrosis, arthrosis, arthritis, polyarthritis, myositis, etc;
— diseases of the respiratory organs: bronchitis, pneumonia, bronchial asthma, tracheitis;
— skin diseases: pyoderma, psoriasis, neurodermatitis, scleroderma, vitiligo, seborrhea, mycosis, elopecia;
— ENT-diseases: rhinitis, tonsillitis, quinsy;
— surgical diseases: physiognomy, badly healing wounds, ulcers, boils, burns and frostbites;
— tuberculosis, its various forms, especially tuberculosis of the skin;
— sepsis (UF-irradiation of blood).

**Indications to laser therapy:**

— diseases and injuries of the locomotor apparatus;
— diseases and injuries of the peripheral nervous system;
— diseases of the cardiovascular system: IEHD, hypertension disease, vascular diseases of the extremities;
— diseases of the digestive organs: ulcer of the stomach and duodenum;
— diseases of the urinogenital system: adnexitis, erosion of the cervix, endometritis, prostatitis;
— diseases and damages of the skin: wounds, burns, bed sores, frostbites, herpes, itching, dermatosis, red flat lichen;
— ENT-diseases: tonsillitis, pharyngitis, laryngitis, otitis;
— thymus-dependent immunodeficiency conditions.

**Indications to piler therapy:**

— skin diseases: acne rash, neurodermatitis, eczema, allergic eruptions, skin itching, early withering of the skin, etc;
— consequences of traumas of the tissues: bruises, strains, traumas of the joints, ribs, etc., arthrosis;
— surgical diseases (badly healing wounds and ulcers);
— ENT-diseases: acute and chronic antritis, frontitis, neuritis of the auditory nerve, tinnitus, laryngitis and pharyngitis;
— dental diseases: paradontitis, paradontosis, gingivitis;
— diseases of the peripheral nervous system.

**Contraindications to phototherapy:**

— malignant neoplasms;
— systemic diseases of blood (especially white);
— feverish conditions;
— local purulent processes;
— acute infectious diseases (except ARI);
— pemphigus;
— cardiovascular insufficiency of III degree;
— essential hypertensionof III degree;
— photodermitis;
— thyrotoxicosis;
— cirrhosis of the liver and marked nephrosclerosis (for UV-rays). It is undesirable to carry out light-warm procedures in the areas of benign tumour location.

## 3.6. Methodological Peculiarities of Phototherapy

All basic kinds of phototherapy can be given in the form of local, segmental-reflex and general procedures.

Procedures of light-warm therapies are usually given in oligothermal and thermal modes, sometimes in hyperthermal (light baths). Their average duration is 10–20 min, 5–15 procedures for the course of treatment.

**UV-therapy** is dosed by means of biodoses. One biodose is the least erythemal time of irradiation of the patient's skin (usually it is lower abdomen) at the distance of 50 cm. It is determined individually, but depends, in particular, on capacity of UV-lamps. Determination of a biodose on the integuments is made by a biodozimeter BD-2. It is a metal plate with 6 rectangular apertures that open during irradiation with an interval of 30 sec. As a result the skin in the first aperture is being irradiated for 30 sec, in the last — for 180 sec. In 24 hrs on the threshold of erythema the biodose is established equal to the time of irradiation of the skin in seconds above that aperture in which the skin has distinctly turned pink (for the shortest time of irradiation).

There are small erythemal (1–2 biodoses), average (3), big (5–8) and hypererythemal doses (over 8 biodoses). Hypererythemal biodoses are basically indicated in some local irradiations of the skin.

Sources of long-wave radiation (320–400 nm), integrated (280–380 nm), and short-wave (180–280 nm) are used for UV-therapy. Sources of LUV and IUV are applied for general influence. All three kinds of rays are used for local influence. Besides, IUV is used for treatment of diseases of the

mucous membranes and for disinfection of the air in the closed premises and water. SUV is also applied for ultra-violet irradiation of blood in special devices. In general influence the anterior and posterior surfaces of the patient's body are alternatively irradiated. Three schemes of general UV-irradiations are accepted: basic, accelerated and slowed down. Daily irradiations begin from 1/4, 1/2 or 1/8 biodoses accordingly and gradually bring them up to 3–4 biodoses. The course of treatment is 15–25 days.

Within the limits of preoperative preparation of patients courses of the general suberythemal and weakly erythemal irradiations are given for 6–8 days.

Local procedures of UV irradiation are carried out on the skin and mucous membranes. Sensitivity of the mucous membranes to UV-radiation is determined by V. N. Tkachenko's method by means of the biodosimeter BUF-1. It represents a plate with 4 apertures which is put on a tube of the radiator located compactly above the nipple where sensitivity of the skin comes nearer to sensitivity of the mucous membranes. The apertures of the plate are opened one by one with an interval of 30 sec, and the biodose is determined in 12–24 hrs.

The irradiation of the mucous membranes begins with 1–1.5 biodoses and gradually increasing by 0.5–1 biodoses bringing them up to 3 biodoses, 5–6 procedures for the course.

Local irradiation of the skin by UV-rays begins with 1.5–2 biodoses. The same area is irradiated 3–6 times with an interval of 1–3 days, increasing the dosage in each subsequent procedure by 0.25–1 biodose. It is possible to separate several areas of irradiation and then procedures are given daily, but on different areas. The method of photochemotherapy — PUVA-therapy — is carried out with a preliminary sensitization of the skin to LUV by means of compounds of furocumarin (puvalen, psoralen, beroxan, psoberan, etc.). Photosensitizers are introduced into an organism perorally and parenterally for some hours or one day prior to irradiation. Then irradiation is carried out beginning with 1/8 of the biodose, bring it up to 3–4 biodoses in general irradiation, and up to 5 biodoses — in local one; 10–12 procedures for the course. It is applied almost exclusively in skin diseases: psoriasis, vitiligo, fungal mycosis, etc.

Optical radiation of red (632 nm) and infrared (800 nm) ranges is more often used for **laser therapy**.

Irradiation by the defocused beam is carried out by the distant technique; the backlash from a radiator to the skin makes 20–30 mm. 1–5 areas are irradiated during one procedure, with total area up to 400 $cm^2$.

Dosing of laser influences is carried out by density of the stream of energy of radiation by means of measuring capacity instruments IM-1 and IM-2.

Duration of the procedures is from 20 sec to 5 min on one area. In influence some areas — it is totally to 20 min. Duration of the procedures of the direct influence on blood is 20–30 min (no more).

Laser influence on one point is more often carried out in contact for 20–30 sec; total duration of the procedures is up to 2–3 min. The procedures are carried out daily or in a day, 10–20 procedures for the course. The repeated course of laser therapy can be made in 2–3 months.

In piler therapy the lamps are installed at the distance of 30–60 cm from the skin, duration of the procedures is 4–8 min, 1–2 times a day, 10–12 procedures for the course.

## 3.7. Equipment for Light-Warm, Ultraviolet and Laser Influences

### Light-thermal devices

— lamps of infrared radiation — LIK-5M;

— lamps of visible (infrared) radiation: Sollux (stationary and desktop) — PLS-6m, OSN-70, etc.;

— a lamp of dark blue light — Minin's lamp;

— electrolight baths for the trunk and extremities;

— small baths with blue rays — VOD-11, KLA-21 (for non-thermal light influence).


*Fig. 10.* Laserotherapeutic unit BTL-5000 laser

### Ultraviolet rays

— selective sources of LUV: DUF-13, UUF-1, UUD-1A, OUT-1, OUK-1, EOD-10, EGD-5.

— integrated sources of UV: DPT-250-1, DPT-375, DPT-1000 (in devices of OKN-11M — tabletop, ORK-21M — on a support). For irradiation of the nasopharynx — UGN-1. Luminescent lamps LE153 in irradiators OUSh-1 (on a support), OUN-2 (tabletop).

### Low intensity lasers

*Rays of the red colour:*

— UFL-01 Berry, FALM-1, ALOK-1 (for intravenous irradiation of blood), ALF, AFDL, BTL-5000, etc. (Fig. 10).

*Infrared lasers:*
— Uzor and Uzor-2K, Milta, ALT-05, Phototron, Orion, Energy, Phyaction-740.

*Combined polychromatic lasers:*
— Medik-1, Mustang, Rikta, ALP-01, LOTON, AZOR-2K, MIT-1.

*Devices for piler therapy:*
— Bioptron, Bioptron-2, Geska.

## Control Questions

1. Give physical determination of the notion "light".
2. What rays are there in the light spectrum?
3. Indicate the wave ranges of long wave UV, medium wave UV and short wave UV?
4. What is luminescence?
5. What is the mechanism of the therapeutic effect of infrared rays? Name the main apparatuses.
6. What is the mechanism of the therapeutic effect of visible rays? Name the apparatuses.
7. What is the mechanism of the therapeutic effect of UV rays?
8. What is the mechanism of the therapeutic effect of low intensity laser rays?
9. What are the main indications to application of infrared rays?
10. What are the main indications to application of UV rays?
11. Name general contraindications to light therapy.

## Control Tests

1. Name one of the signs of the ultraviolet erythema:
A. Spotty red colour of the skin
B. Develops in the process of exposure
C. Develops in 3–12 hrs after irradiation
D. Has no clear borders
E. Disappears without leaving a trace in 20–30 min after irradiation

2. What is maximum permissible area of irradiation of the skin in the erythema doses?

A. 300–400 $cm^2$
B. 800 $cm^2$
C. 600 $cm^2$
D. 500 $cm^2$
E. 200 $cm^2$

3. What is the distance for biodosimetry of medium-wave ultraviolet irradiation?

A. 30 cm
B. 75 cm
C. 50 cm
D. 100 cm
E. 25 cm

4. Name indications for the therapeutic application of ultraviolet irradiation in the erythema doses:

A. Disturbances of metabolism
B. Secondary anemia
C. Diseases of the peripheral nervous system with the pronounced pain syndrome
D. $D_3$-hypovitaminosis
E. Systemic lupus erythematosus

5. Laser emission causes:

A. Improvement in the regional blood circulation
B. Enhancement of the venous wall tone
C. Contraction of the muscles
D. Increase in blood coagulability
E. Spasmolytic effect

*Chapter 4*

# AEROSOL AND AEROION THERAPY

Aerosol therapy is an application of medical products, biological substances and physical agents in the form of aerosols with a preventive or medical purpose. Medical aerosol is a two-phase system consisting of the homogeneous air (gas) of the disperse medium and particles of medical substance suspended in it. In electroaerosols particles of medicinal substance have an additional electric charge.

Advantages of the aerosol way of delivery of medical substance are: creation of high local concentrations for direct influence on the pathological focus; increase of biological availability and pharmacological activity due to increase in volume of medicinal suspension and contact surface of the affected tissues; fast absorbability and entry into the tissues; painlessness of introduction; no disorders in the gastrointestinal tract and liver; reduction of incidence and expressiveness of side-effects in the systemic application of medical products.

Solutions of medical products (muco-, and broncholytics, anti-inflammatory and immunostimulating preparations, etc.), biologically active substances (mummiye, peloidin), mineral waters (hydrocarbonate and sodium chloride), various phytopreparations, vegetable oils and ground firm substances (aerosol of sodium chloride) are used in the form of aerosols.

Depending on the area of influence there are *inhalation and external aerosol therapy.* Inhalation therapy is divided into *individual and group.* Group inhalations (simultaneous influence on several patients) create the uniform disperse medical air in the limited premise space. In individual application direct introduction of medicinal substance in the respiratory tracts of one patient is made.

Seven *basic kinds of inhalations* are distinguished: steam, thermo-damp, damp (aerosols of the room temperature), oil, inhalation of dry medical products (insufflation and spraying), air and ultrasonic.

Aerosols are divided according to *a degree of dispersiveness*: *fine* (0.5–5 mc), *medium (5*–25 mc), *gross* (25–100 mc), *atomized* (100–250 mc), *globular* (250–400 mc).

Depth of aerosol penetration into the respiratory tracts and stability depends on dispersiveness as 30–50% of the inhaled substance is removed by the exhaled air. Practically aerosols sized up to 1 mc do not settle on the mucous membrane of the respiratory tracts in exhalation. Fine aerosols settle basically on walls of the alveoli, bronchioles and proximal bronchial tubes. The particles over 8 mc do not get further the main bronchial tubes and settle mainly in them and the trachea. Gross particles settle mainly in the nasopharynx, as well as in the throat and trachea. Drop aerosols settle practically completely in the nasopharynx and on the nose mucosa.

***Medical effects*** of inhalation therapy are promoted first of all by pharmacological or biologically active influence of the inhaled substance (antibacterial, broncholytic, anti-inflammatory, mucolytic, etc.) as well as the temperature, pH of the inhaled mixture and electric charge of the aerosol particles.

**Electroaerosols** possess more expressed medical action as the electric charge intensifies pharmacological activity of the inhaled substance and changes electric potential of the tissues. Negatively charged aerosols increase drainage function of the bronchial tubes, due to stimulation of oscillatory movements of the epithelium cilia and control spasms of the smooth muscles of the bronchi. Positively charged aerosols dry up the mucous membrane of the trachea and bronchi, suppress kinetic activity of the epithelium cilia, and promote increase of hypersensitivity of the bronchi and spasm of their smooth muscles.

***The devices*** applied for preparation of aerosols are subdivided into portable (AI-1, PAI-1, PAI-2, Aerosol P-1, IP-2, Dissonik, Climamaske; ultrasonic — Vulkan, Musson, Taifun, Albedo, Tuman, the equipment of the firms DeVilbiss, TUR-Electromedizin, Omron, Kendall; compressor — of the firms Zambon, DeVilbiss, PARI, Omron and stationary — UI-2, Aerosol U-1, Aerosol K-1. Portable devices Elektroaerosol-1 and GEI-1 as well as devices for group inhalations PEK-1 and GEK-2 are applied for electroaerosol therapy.

***Indications for inhalation therapy:*** acute and chronic inflammatory diseases of bronchi and lungs (bronchitis, tracheitis, pneumonia, etc.); bronchial asthma; emphysema of the lungs; multiple bronchiectasis; occupational diseases of the lungs; cystic fibrosis; whooping cough; tuberculosis; diseases of the ENT-organs (sinusitis, rhinitis, laryngitis, pharyngitis); respiratory viral infections. For external aerosol therapy*:* diseases of the ENT-organs; damages of the skin and mucous membranes; burns; frostbites; dermatological diseases; trophic ulcers.

***Absolute contraindications:*** individual intolerance of medicinal substance, pulmonary bleeding, vestibular disorders, pneumothorax, pronounced emphysema of the lungs, giant cavities in the lungs, Ménière's disease with frequent attacks.

***Relative contraindications*** (depending on a kind of inhalation and inhaled medicinal substance): cardiopulmonary insufficiency of II–III stages, epilepsy, essential hypertension of III stage.

**Artificial microclimate by hydrochloric aerosol** *(halotherapy, haloaerosol therapy, chamber speleotherapy)* is a medical application of the disperse air by the aerosol of sodium chloride.

Increased osmolarity of the bronchial contents promotes: dilution of sputum, reduction of edema of the mucous membrane of the bronchial tubes and alveoli, stimulation of mucociliary clearance and reparative processes in the mucous membrane, improvement of microcirculation both of local lymph and blood circulation, training of receptors of the bronchial muscles and normalization of neuroreflex regulation of their tone, inhibition of vital functions of pathogenic microorganisms, stimulation of the functional condition of the immune and endocrine systems.

Dry and moist hydrochloric aerosols are used for group and individual inhalations.

To create therapeutic medium by hydrochloric aerosol there is a plenty of various devices and their modifications of industrial and handicraft production. The devices USA-1, USA-2, AGT-01 are used for group inhalations, GISA-01 (Galoneb) — for individual ones.

***Medical effects:*** anti-inflammatory, mucolytic, mucokinetic, desensitizing, immunomodulating, regenerative, antimicrobial, antimucotic.

***Indications:*** bronchial asthma and chronic (recurrent) bronchitis in the period of remission, prolong course of bronchitis and pneumonia, allergic laryngotracheitis (laryngitis) and whooping-cough in the period of reconvalescence, diseases of ENT-organs (allergic rhinitis, ozena, allergic rhinosinusopathies, chronic pharyngitis), allergodermatosis, sanation of frequently falling ill children.

***Contraindications:*** pronounced hypertensive-liquor syndrome, essential hypertension of I–III degree, multiple bronchiectasis, pronounced emphysema of the lungs, cardiopulmonary insufficiency of II–III degree, insufficiency of blood circulation of II–III degree, thromboembolism, fibromyoma and myoma of the uterus, chronic glomerulonephritis, inflammatory diseases of the kidneys (pyelonephritis, pyelitis, cystitis) and chronic sinusitis with frequent aggravations.

**Aeroion therapy** is application of positively or negatively charged particles of the air — aeroions — with the medical purpose.

Light aeroions being in contact with cells of the mucous membrane of the respiratory tracts and skin change their electric potential and bring about formation of chemically active atoms and molecules (ozone, binary oxygen, nitrogen dioxide, etc.) in the tissues. As a result metabolic processes are stimulated leading to formation and release of biological active substances and mediators of the nervous system, intensification of the local blood flow and penetration of the activated forms of oxygen through the alveolar-capillary barrier, control of the spasms of fine bronchial tubes, and movement of the ciliary epithelium becomes more active. Therapeutic concentrations of negatively charged aeroions suppress vital functions of microorganisms, and exert a high bactericidal effect.

There are *local* and *general* aeroion therapy. While carrying out general aeroion therapy the patient (patients) is in the premise where therapeutic concentration of aeroions ($1–1.5\times10^{11}$) is created. During the procedures of local aeroion therapy the directed stream of aeroions (electroeffluvia) influences the certain site of integuments. Negatively charged ions increase excitability of the skin receptors, and positive ones lower it (Table 2).

**Negatively charged ions are generated by devices** AF-3, FA-5-3, FA-50-5, EEF-01, AIR-2, KKI-2M, Elion-132, Hippocrates, AETI-01, Gelios (Chizhevsky's chandelier), ISTION. Positive or negative aeroions are received by means of the thermoionizer.

***Medical effects:*** antiinflammatory, mucokinetic, regenerative, immunostimulating, antimicrobial, antimycotic, sedative, analgesic.

***Indications for general aeroion therapy:*** diseases of the respiratory organs (bronchial asthma, acute and chronic, bronchitis, pneumonia in the stage of resolution, tuberculosis of the lungs, occupational diseases of the lungs), diseases of ENT-organs (rhinitis, ozena, laryngitis), diseases of the cardiovascular system (essential hypertension of I–II stages, vegetovascular dystonia), dysfunctions and diseases of the CNS (neurasthenia, migraine, sleep disorders, asthenic condition, overfatigue, decreased working capacity), with the purpose of immunostimulation.

*For local aeroion therapy:* neurodermatitis, itching dermatosis, open wounds, damages of the integuments, trophic ulcers, bed sores with danger of infection, diseases of the peripheral nervous system (neuralgia, paresthesia, hyperesthesia, neuralgias), myositis.

***Contraindications:*** organic diseases of the CNS, acute disturbance of the cerebral circulation, depressions, postinfarction cardiosclerosis, ischemic heart disease with exertional angina pectoris of III FC, pneumonia in the acute phase, pronounced emphysema of the lungs, rheumatoid arthritis in the period of aggravation, pregnancy, increased sensitivity to ionized air.

Table 2. **Medicinal substances for inhalation**

| Medicinal substance | Solution | Dosage | Inhalator type |
|---|---|---|---|
| Antimicrobial substances | | | |
| Furacillin | 0.02% | 3–5 ml | C, Us, Tm |
| Chlorphil | 0.1% (alcohol sol.) | 5–10 drops | C, Us, Tm |
| Novoimanin lipt | 0.1% (alcohol sol.) | 5–10 drops | C, Us, Tm |
| Tincture of Calendula (eucalyptus, romusalon) | | 20 drops | C, Tm |
| Juice of garlic (onion) | | 2 ml | Tm |
| Bronchicum inhalate | | 5 ml | S |
| Eucalyptus oil | | 5 ml | S |
| Anise oil | | 5 ml | S |
| Oil (menthol + thymol) | 0.25–3% + 1–2% | 5 ml | S |
| Anti–inflammatory drugs | | | |
| Budesonid | 0.05%–0.1% | 1–2 ml | C, Us |
| Prednisolone | 25%, 30% | 0.5–1 ml | C, Us |
| Hydrocortisone | | 0.5–1 ml | C, Us |
| Intal (cromohexan) | 1% | 2 ml | C, Us |
| Heparin (clexan) | | 5–10,000 units | C, Us |
| Mucolytics and mucokinetics | | | |
| Acetylcystein (mucosolvin, mucomist) | 10%; 20%<br>20% | 1–5 ml<br>1–5 ml | C, Us<br>C, Us |
| Bromhexine (bisolvon) | 0.02% | 2 ml | C, Us |
| Ambroxol (lasolvan) | 0.75% | 2 ml | C, Us |
| Mistabron (mesna) | 20% | 1–3 ml | C, Us |
| Trypsin | | 5 ml | C, Tm |
| Chymotrypsin | | 5–10 ml | C, Tm, |
| Desoxiribonuclease | 0.2% | 2–5 ml | C, Tm |
| Pulmosim | 0.25% | 1–3 ml | C, Us |
| Solution of NaCl | 1–3% | 2 ml | C, Us, Tm |
| Sodium hydrocarbonate | 1–2% | 20–30 ml | Tm |
| Potassium iodide | 0.1%, 1% | 1 drop per per 1 ml | Tm |

*Continuation of table 2*

| Medicinal substance | Solution | Dosage | Inhalator type |
|---|---|---|---|
| Hydrocarbonic mineral water | up to 3% | 25–50 ml | C, Us, Tm |
| Bronchodilators | | | |
| Adrenalin | 0.1% | 1–20 drops | C, Us |
| Ephedrine | 2%, 5% | 0.5–1 ml | C, Us |
| Euspirane (isoprenaline) | 0.5–1% | 5–15 drops | C, Us |
| Alupent | 0.2% | 0.5 ml | C, Us |
| Salbutamole | 0.1–0.16% | 3–5 ml | C, Us |
| Ventoline | 0.05–0.08% | 3–5 ml | C, Us |
| Solben | 5% | 1 ml | C, Us |
| Stern-Neb Salamol | 0.1% | 2.5 ml | C, Us |
| Phenoterol (berotec) | 0.1% | 2 ml | C, Us |
| Brekanile (terbutalin) | 1% | | C, Us |
| Atropine | 0.1% | 0.25–0.5 ml | C, Us |
| Metacyne | 0.1% | 0.25–0.5 ml | C, Us |
| Atrovent | 0.025% | 4–8 drops | C, Us |
| Berodual | 0.05% phenterol + 0.025% atrovent | | C, Us |
| Euphylline (aminophyllin) | 2.4% | 2–5 ml | C, Us |
| Immunomodulators and biologically active substances | | | |
| Lysocim | 0.5% | | Tm |
| Levamisol | 0.01% | | Tm |
| Prodigiosan | 0.02%, 0.04% | | Tm |
| Sodium nucleinate | 1% | 4 g | C, Tm |
| Tincture of Eleuterococcus (Gingseng, Echinacea) | | 0.25–0.5 ml | Tm |
| Mummiye | Water solution | 0.3–0.5 g | C, Us, Tm |
| Peloidin | | 10–30 ml | C, Us, Tm |
| Extract of aloe | | 2–5 ml | C, Tm |
| Propolis | 20% | 2–5 ml | Tm |

*End of table 2*

| Medicinal substance | Solution | Dosage | Inhalator type |
|---|---|---|---|
| Coating substances (oils) | | | |
| Sea buckthorn | | 10 ml | O |
| Eucalyptus | | 5 ml | O |
| Anise | | 5 ml | O |
| Peach | | 10 ml | O |
| Wild rose | | 5 ml | O |
| Camphor | | 10 ml | O |
| Vaseline | | 10 ml | O |

*Note to the table:* inhalator type: Us — ultrasonic, Tm — thermomoist, C — compressor, O — oil, S — steam.

## Control Questions

1. What is aerosol- and aeroionotherapy? Give the determination.
2. Name indications, contraindications and age limitations for administration of aerosol- and aeroionotherapy.

## Control Tests

1. The local reaction to aerosol therapy is manifested in the form of:
A. Reduction and deepening of breathing
B. Increase in motion of the cilia of the ciliated epithelium
C. Superficial breathing with its acceleration
D. Increase in the phlegm viscosity
E. Bradicardia

2. What aerosols are optimums in the lung disease?
A. Low-dispersed
B. Moderately dispersed
C. Highly dispersed
D. Fine-dispersed
E. Globular

3. Indication for aerosol therapy is:
A. Ischemic heart disease, exertional angina pectoris of I-II FC
B. Acute pneumonia in the initial stage
C. Spontaneous pneumothorax
D. Skin and mucous membrane damage
E. Chronic gastritis

4. Indicate contraindications for aerosol therapy:
A. Tuberculosis of the upper respiratory tract and lungs
B. Trophic ulcer
C. Pulmonary hemorrhages
D. Burns
E. Acute and chronic diseases of the oral cavity

5. Optimum for the effective influence on the function of the ciliated epithelium of the bronchi in aerosol therapy is pH of the medium:
A. 3.0–5.0
B. 2.5–4.0
C. 6.0–8.0
D. 8.0 and more
E. IT does not matter

*Chapter 5*

# TREATMENT BY FACTORS OF PREFORMED AIR

The basis of medical action of these physiotherapeutic methods is influence on an organism of the person by the changed parameters of the basic atmospheric factors — gas structure of the inhaled air and barometric pressure. As a result the partial pressure changes in blood gases (oxygen and carbonic gas), starting the whole complex of difficult biophysical and biochemical processes resulting in essential stimulation of a functional condition of the major systems of an organism (central and vegetative nervous, immune, endocrine, etc.). It is essentially important that these processes are physiological for our organism as the mankind contacts with a change of the given parameters of the air during all its history, therefore mechanisms of adaptation reactions to them are fixed at a reflex level.

The methods of the medical influence of this group of physical medical factors can be divided into four subgroups:

1. Change of gas structure of the inhaled air mixture.
2. Change of barometric pressure.
3. Combined change of gas structure and barometric pressure of the inhaled air mixture.
4. Use of the activated forms of oxygen.

## 5.1. Change of Gas Structure of the Inhaled air Mixture

**Normobaric hypoxic therapy** is a medical application of a gas mixture with the lowered contents of oxygen at normal atmospheric pressure. The gas mixture containing 10% of oxygen and 88–90% of nitrogen is used. During the procedure hypoxic phases (5–15 min) alternate with inhalation of the atmospheric air — *interval hypoxia (interval hypoxic trainings),* or a session of breathing air mixture with 10% contents of oxygen within 60 min is given — *periodic hypoxia.*

Irritation of the respiratory centre of the medulla oblongata by carbonic acid and hypoxia promote: normalization of processes of the vegetative regulation; increase in alveolar ventilation, velocity of blood circulation and contractive functions of the myocardium; reduction of the increased arterial pressure; increase of mucociliary transport and velocity of oxygen utilization by the tissues; reduction of bronchial obstruction; stimulations of phagocytic component of immunity; activation of the antioxidant systems and processes of oxidative phosphorylation.

***Apparatuses:*** hypoxitators Borei, Everest, MM, NUR 10-1000-0, KShAT.

***Medical effects:*** vegetotropic, immunostimulating, regenerative, bronchodrainage, desensitizing, broncholytic, hemostimulating.

***Indications:*** bronchial asthma, chronic bronchitis, vegetovascular dystonia, essential hypertension of I–II stages, ischemic heart disease with exertional angina pectoris of I–II FC, allergic diseases (allergic rhinitis and rhinosinusitis, allegrodermatosis), thyreotoxicosis, dysfunctions of the central and autonomic nervous system (asthenia, overfatigue, etc.), anemia (including pregnant women), vibratory disease.

***Contraindications:*** acute infectious diseases, multiple bronchiectasis, pronounced emphysema of the lungs, cardiopulmonary insufficiency of II–III degrees, essential hypertension of III stage, consequences of the craniocerebral injury, the pronounced disturbances of the systemic and cerebral blood circulation, fibromyoma and myoma of the uterus.

**Oxygenic therapy** is a course application of medical oxygen (100%) under atmospheric pressure.

In the course application hyperoxia promotes: increase in the level of oxyhemoglobin in blood; stimulations of anabolic processes; reduction of tissue hypoxia, arterial hypertension, rate of the heart contractions and insufficiency of the right ventricle; restoration of a normal ratio of the fast and slow phase of the sleep.

***Medical effects:*** antihypoxic, disintoxication, anabolic, vasodilating, cardiotropic.

***Indications:*** acute respiratory insufficiency, preparation for prolonged operations, intoxication, arterial hypoxemia, bronchial asthma, cardiopulmonary insufficiency of II-III degree, insufficiency of blood circulation, neurocirculatory dystonia, essential hypertension of I–II stages.

***Contraindications:*** acute and chronic (in the period of aggravation) inflammatory diseases of the lungs, spontaneous pneumothorax, multiple bronchiectasis, severe course of bronchial asthma, fibromyoma and myoma of the uterus.

*In long-term hyperoxia oxygen has a damaging effect on the mucous membrane of the alveoli and respiratory tracts.*

**Carbogenic therapy** is a medical application of gas mixtures with the increased contents of oxygen (95–97%) and carbon dioxide (3–5%).

Hypercapnia causes: the increase in the alveolar ventilation and circulation velocity; stimulation of erythrocyte release from the depot and hemopoiesis; acceleration of dissociation of carboxic hemoglobin and methemoglobin.

***Apparatuses:*** amalgamators of oxygen and carbonic gas (dosed).

***Medical effects:*** disintoxication, vegetotropic, hemostimulating.

***Indications:*** poisonings by carbon dioxide or poisonous mushrooms, neurasthenia, asthenic conditions, anemia, ischemic heart disease, ischemia of the brain tissues, vestibulopathy.

***Contraindications:*** acute diseases (chronic ones in the stage of aggravation) of internal organs, essential hypertension of II–III stages, consequence of the craniocerebral trauma, pronounced disturbance of the cerebral circulation, ischemic heart disease with exertional angina of II–III FC, pronounced emphysema of the lungs, severe course bronchial asthma.

**Oxygenic heliotherapy** is a medical application of gas mixtures with the increased contents of oxygen (30–40%) and helium (60–70%).

Reduction in density of the inhaled mixture promotes: reduced resistance to breathing in the respiratory tracts; bradipnoe; increased bronchial patency, respiratory volume, alveolar ventilation, blood filling of the internal organs, coronary blood flow, contractive abilities of the myocardium and contents of oxygen in blood; intensification of metabolism of the pulmonary tissue; stimulation of the cellular component of immunity; development of hypocapnic alkalosis.

***Apparatus:*** Sula.

***Medical effects:*** antihypoxic, broncholytic, cardiotropic, regenerative, immunostimulating.

***Indications:*** chronic obstructive diseases of the lungs in the period of remission, cardiopulmonary insufficiency of I–II degrees.

***Contraindications:*** acute diseases (chronic ones during aggravation) of the bronchi and lungs with respiratory insufficiency of I degree, multiple bronchiectasis, pronounced emphysema of the lungs, essential hypertension of II–III stages.

## 5.2. Change of Barometric Pressure

**Hypobaric therapy** is a medical application of atmospheric air under the lowered barometric pressure. Barometric pressure during the course of treatment is lowered gradually from 640 mm Hg to 490 mm Hg.

Reduction of oxygen partial pressure in the blood promotes: release of erythrocytes from blood depots; stimulation of hemopoiesis, the antioxidant systems of blood and processes of oxidative phosphorylation, increase of pulmonary ventilation.

***Apparatuses:*** many-placed hypobaric chambers (Ural-1, Ural-2, Ural-3), single one — Germes.

***Medical effects:*** hemostimulating, vegetotropic, disintoxicating, antihypoxic, metabolic.

***Indications:*** bronchial asthma, chronic obstructive bronchitis, iron-deficiency and hypoplastic anemia, toxic affections of blood, neurocirculatory dystonia, essential hypertension of I–II stages, diabetes, neurasthenia, vegetovascular dysfunctions, asthenic conditions, chronic inflammatory diseases of the female genitals, preparation for delivery.

***Contraindications:*** consequences of the craniocerebral trauma, pronounced disturbances of the cerebral blood circulation, tendency to bleedings, fibromyoma and myoma of the uterus, chronic hepatitis, chronic glomerulonephritis, chronic renal failure, diabetes in the stage of decompensation, diffuse toxic goiter, claustrophobia, ENT-diseases with barodysfunction.

**Hyperbarotherapy** is a medical application of a gas mixture (14% of oxygen and 86% of nitrogen) under the increased barometric pressure.

The increase of partial pressure of gases of the inhaled air promotes: development of hypercapnia (normalization of the processes of vegetative regulation; increase of the alveolar ventilation, velocity of blood circulation and contractive functions of the myocardium; reduction of the increased arterial pressure; increase of mucociliary transport and velocity of oxygen utilization by the tissues; reduction of bronchial obstruction; activation of the antioxidant systems and processes of oxidative phosphorylation) and change of kinetics of an organism tissue saturation by gas (prevents development of gas embolism).

***Apparatuses:*** barochamber — PDK-2 (diving).

***Medical effects:*** antihypoxic, vegetotropic, bronchodrainage, vasodilating, broncholytic, antiembolic.

***Indications:*** chronic nonspecific diseases of the lungs, pneumonia in the stage of convalescence, aeroembolism, decompression disease.

***Contraindications:*** multiple bronchiectasia, pronounced emphysema of the lungs, pneumothorax, severe course of bronchial asthma, insufficiency of blood circulation of I–III degree, cardiopulmonary insufficiency of II–III degree, diseases of ENT-organs with barodysfunction, pronounced disturbance of cerebral blood circulation, claustrophobia.

**Local barotherapy** (vacuum-gradient barotherapy, vacuum massage) is a medical influence by the rarefied air or air under the increased barometric pressure upon the limited sites of integuments.

*Local reduction in barometric pressure promotes:* increase of microcirculation, local blood and lymph circulation, reduction of hypostasis of the tissues (restoration of tactile and painful sensitivity); formation of petechia (stimulation of the reparative processes, hemopoiesis), improvement of dermovisceral innervation (increase of blood supply of internal organs and peristalsis of the intestines).

*Local barocompression promotes:* reduction of permeability of the capillary walls and local hyperoxia (reduction of tissue hypoxia and stimulation of anabolic processes).

***Apparatuses:*** Alodek-4M, Elektronika-VM-01, Endovac, devices for vacuum massage VM-50-01 Micro-V, medical cups, Phyaction Guidance E, BTL-12.

***Medical effects:*** regenerative, hemostimulating, analgesic, lymphodrainage, broncholytic, antispastic, vasodilating.

***Indications:*** neuralgia, chronic obstructive diseases of the lungs, pneumonia in the stage of resolution, atonic colitis, prostatitis, spasm of the smooth muscles of internal organs, osteochondrosis of the spine (including paravertebral cup massage), trophic ulcers (in barocompression).

***Contraindications:*** inflammatory diseases (damage) of the skin and hypodermic cellular tissue, varicose veins, thromboembolism, ischemic heart disease with exertional angina of II FC, essential hypertension of II–III stages, reconstructive operations on vessels.

**Segmentary vacuum therapy** is a medical influence on extensive segmentary zones or extremities of the patient by lowered or increased barometric pressure.

**Hypobaria** promotes intensification of microcirculation and regional blood and lymph circulation; increase of the number of functioning arteriovenous anastomoses and shunts; change of dermovisceral innervation and general hemodynamics.

**Hyperbaria** promotes elimination of venous or lymphostasis; reduction of permeability of the blood and lymphatic vessel walls; enhancement of metabolism of the tissues.

**Combined use of hypobaric and hyperbaric influences** leads to elimination of hypostasis, improvement of microcirculation, training of the vascular tone, and stimulation of metabolic and reparative processes.

***Apparatuses:*** Alodek-4A, APKU, Kravchenko's barochamber TOMA-902, AU-7A.

***Medical effects:*** hemodynamic, lymphodrainage, metabolic.

***Indications:*** obliterating atherosclerosis and endarteritis, diabetic angiopathy, damages of the joints, ligaments, muscles, bones (in 48 hrs after a trauma).

***Contraindications:*** inflammatory diseases of the skin and hypodermic cellular tissue, thrombophlebitis, varicose veins, ischemic heart disease with exertional angina of III FC, essential hypertensionof II-III stage, reconstructive operations on vessels.

## 5.3. Combined Change of Gas Structure and Barometric Pressure of the Inhaled Air (Gas) Mixture

**Long low-progressive oxygenic therapy** is a medical use of air mixture enriched in oxygen (30–100%), under the low pressure.

Hyperoxia and hyperbaria promote: increase of the partial pressure of oxygen in blood and tissues, amount of oxyhemoglobin in blood; stimulation of metabolic processes; reduction of tissue hypoxia, arterial hypertension, rate of cardiac contractions and insufficiency of the right ventricle.

***Apparatuses:*** concentrators of oxygen Companion-492a (Puritan-Bennet), DeVibiss, DeVo2/44, DP90/VP90, Monnal, DCC.

***Medical effects:*** antihypoxic, disintoxication, metabolic, vasodilating, cardiotropic.

***Indications:*** respiratory and cardiopulmonary insufficiency of I degree, insufficiency of blood circulation, night apnoe, adiposity, essential hypertension of I–II stages.

***Contraindications:*** multiple bronchiectasis, pronounced emphysema of the lungs, acute and chronic (in the stage of aggravation) inflammatory diseases of the lungs, myoma and fibromyoma of the uterus.

**Oxygenobarotherapy** (hyperbaric oxygenation) is a medical application of medical oxygen under the increased barometric pressure.

Increased partial pressure of oxygen in blood promotes: stimulation of oxidative phosphorylation and antioxidant systems; reduction of alveolar ventilation, rate of breathing and cardiac contractions, velocity of blood circulation; reduction of the contents of erythrocytes in blood and increase in time of blood coagulation.

***Medical effects:*** disintoxication, antioxidant, metabolic, reclaiming, immunostimulating.

***Apparatuses:*** single barochamber — Irtysh-MT. BL-3, Oka-MT, Yenisei-3, BLKS-301, BLKS-301M, NUOH, Mana-2, HTK-1200; many-placed — PDK-2 and PDK-3, Drager Hyperbaro Therapiekammer HTK.

***Indications:*** toxic affections of blood (poisoning by carbon oxide, poisonous mushrooms, chlorine, etc.), sepsis, peritonitis, anaerobic infection, ulcer of the stomach and duodenum, nonspecific ulcerous colitis, hepatitis,

neurocircular dystonia, neurasthenia, asthenic conditions, obliterating diseases of vessels of the extremities, diseases and damages of the osseomuscular system, disease and damage of the oral mucosa, persistent nonhealing wounds, trophic ulcers, burns, thyreotoxicosis, diabetes, chronic inflammatory diseases of the female genitals, preparation for delivery.

***Contraindications:*** diseases of the respiratory organs (acute and chronic), insufficiency of blood circulation of II stage, essential hypertension, fibromyoma and myoma of the uterus, ENT-diseases with disturbed barofunctions, claustrophobia.

**Carboxybarotherapy** is a medical application of gas mixtures with the increased contents of oxygen and carbon dioxide under the increased barometric pressure.

Increase of the concentration and partial pressure of oxygen and carbonic gas in the inhaled air promotes: stimulations of the respiratory and vascular center (increase of pulmonary ventilation, velocity of circulation and microcirculation); activation of the antioxidant systems and tissue metabolism; stimulation of hemopoiesis.

***Apparatuses:*** barochamber — PDK-2 (diving).

***Medical effects:*** disintoxication, antihypoxic, vegetotropic, hemostimulating.

***Indications:*** poisonings with poisonous mushrooms, neurasthenia, asthenic conditions, chronic nonspecific diseases of the lungs, anemia.

***Contraindications:*** acute diseases (chronic exacerbations) of the internal organs, multiple bronchiectasis, pronounced emphysema of the lungs, pronounced dyscirculation of the brain and coronary blood circulation, essential hypertensionof I-II degree, cardiopulmonary insufficiency of II–III degree, severe course of bronchial asthma, diseases of ENT-organs with disturbance of barofunction, claustrophobia.

## 5.4. Use of the Activated Forms of Oxygen

**Ozone therapy** is a medical application of the ozone-oxygen gas mixture, the ozonized solutions and oils.

Application of ozone promotes: stimulation of the antioxidant systems; improvement of microcirculation and lymph flow, rheologic properties of blood and its oxygenation; enhancement of metabolic processes, blood supplies of the myocardium, placenta and fetus; activation of the immune system; destructions of pathogenic microorganisms and viruses.

***Apparatuses:*** VP-2000, Ozonomatic, Bozon, UOTA-60-1 Medozon.

***Medical affects:*** bactericidal, virusocidal, antimycotic, antihypoxic, immunomodulating, trophic, regenerative, disintoxication, hypocoagulating.

***Indications:*** ischemic heart disease with exertional angina of I–III FC, essential hypertension of I–II stages, vegetovascular dystonia, obliterating atherosclerosis and endarteritis, infectious endo- and myocarditis, acute and chronic nonspecific diseases of the lungs, diabetes, ischemic insult, multiple sclerosis, ulcer of the stomach and duodenum, chronic gastritis (duodenitis, colitis, hepatitis), pancreatitis, anal fissures, peritonitis, sepsis, trophic ulcers, burns, osteomyelitis, diseases of the skin of allergic and infectious etiology, acute and chronic inflammatory diseases of the female sexual organs, uretritis, prostatitis, gestosis, dental diseases (stomatitis, parodontitis, parodontosis), ENT-diseases (otitis, mesotympanitis, sinusitis, tonsillitis).

***Contraindications:*** tendency to bleedings, hemorrhagic insult, acute alcoholic intoxication, thrombocytopenia, the early period after various bleedings, epilepsy, disposition to spasms, glomerulonephritis, intolerance of ozone, diffuse toxic goiter.

**Singlet-oxygen therapy** is a medical application of singlet oxygen (the activized condition of a molecule of oxygen).

In singlet-triplet dimole transition singlet energy is released which destroys free radicals, breaks the chain of the pathological reaction with formation of hydrogen peroxide, and promotes: improvement of microcirculation, rheologic properties of blood and metabolic processes; inhibition of vital functions of pathogenic microorganisms and activity of allergic processes.

***Apparatuses:*** Valkion, MIT-C.

***Medical effects:*** antioxidant, trophic, detoxication, antimicrobic, hypocoagulating, desensitizing.

***Indications:*** allergic diseases, bronchial asthma, chronic obstructive bronchitis, ischemic heart disease, obliterating endarteritis, vegetovascular dystonia, neurosis, neurasthenia, asthenic conditions, diabetes, burns of a mild and moderate degree of severity, rheumatism.

***Contraindications:*** tendency to bleedings, the early period after various bleedings, hemorrhagic stroke, glomerulonephritis.

## Control Questions

1. Enumerate therapeutic physical factors with changing barometric pressure.
2. Name the main mechanisms of their therapeutic effect.

## Control Tests

1. What therapeutic effect does local barotherapy produce?
A. Myostimulating
B. Bactericidal
C. Hemocoagulative
D. Vasoactive
E. Sedative

2. Indication for local barotherapy is:
A. Trophic ulcer of the shin
B. Varicose disease
C. Urolithiasis
D. Ulcer, stomach ulcer
E. Pneumonia

3. Local barotherapy is contraindicated in:
A. Obliterating atherosclerosis of the lower extremity, stenosis of the 1st degree
B. Thrombophlebitis
C. Osteochondrosis of the spine
D. Pneumonias in the proliferative phase of inflammation
E. Trophic ulcer of the shin

4. Normobaric hypoxitherapy is contraindicated in:
A. Iron-deficiency anemia
B. Ishemic heart disease, exertional angina pectoris of I FC
C. Bronchial asthma with rare attacks
D. Disorder of the cerebral circulation
E. Osteochondrosis of the spine

5. Oxygenobarotherapy is indicated in:
A. Poisoning with carbon oxide
B Claustrophobias
C. Acute bronchitis
D. IHD, exertional angina pectoris of III FC
E. Pneumonias

*Chapter 6*

# MECHANICAL FACTORS THERAPY

Mechanical medical influences can be divided into four groups:

1. Influencing by spasmodic mechanical movement, pressure: massage, manual therapy, medical distraction, nonrhythmical vacuum barotherapy, acu- and mechanopressure.

2. Influence by rhythmic mechanical fluctuations: vibration, heard sound, ultrasound, rhythmic vacuum barotherapy, mechanotherapy by special devices.

3. Immobilization: fixing corsets, belts, collars, bandages, dressings.

4. Irritation of the neuroreceptor apparatus: acupuncture, applicators of Kuznetsov, Lyapko, etc.

The first and second groups bring mechanical energy into the tissues; it leads to changes of the lymph and blood flow, permeability of the tissues, activation of metabolism, elimination of displacement and incarceration of the tissues (manual therapy, distraction), elimination of the painful foci and increase of the muscle tone, change of the arterial pressure, development of biologically active substances, etc.

The third group, by blocking joints, eliminates the painful irritation promoting spasms of transversal striated and smooth muscles.

The fourth group, causing additional irritation of neuroreceptors, blocks and weakens the basic painful sensation, exerts tonic influence on the CNS.

Mechanical medical influences can be carried out in the water: vortical and pearl baths, underwater shower-massage, vibration and ultrasonic procedures in baths and small baths.

## 6.1. Medical Massage

Medical massage is a group of methods of mechanical influence on the tissues of the patient which are realized by hands of the masseur or by means of special apparatuses and devices. Massage can be external and cavernous: massage of the gums, massage of the prostate through the rectum. Waterless and water methods of massage are applied: underwater shower-massage, hands of the masseur in a bath, Charcot's douche, etc. Different variants of pneumomassage are being developed: wave, arrhythmic, etc.

Besides classical massage, there are various other variants: point, segmentary, connective tissue, periosteal, cup, vibration, etc. National kinds of massage are applied in different countries: Swedish, Turkish, Indian, etc.

Massage can be carried out in the form of general and local procedures: massage of the head and collar zones, spine, thorax, stomach, extremities, etc.

The mechanism of medical action of massage depends on its technique, a place of the influence, whether it is general or local.

Under the influence of massage the lymph current is accelerated 6-8 times, pathological exudates resolve much more quickly. Massage activates capillary blood circulation (ten times), increases temperature of the skin, and exerts hypotensive or normalizing effect on AP (depending on the zone and force of influence). General energy massage increases the arterial pressure by 10–15 mm and more. Under the influence of massage of the collar zone the increased intracranial pressure decreases. Massage of the lumbosacral areas, legs, arms or back improved parameters of EEG (there is improvement of blood supply, oxidation-reduction processes in the nervous tissue by reflex). Massage exerts positive influence on the autonomic nervous system with primary activation of its sympathetic part.

Massage procedures depending on intensity and techniques have sedative, tonic or anesthetizing effect on the neuroreceptors of the skin. It results in reflex influence on the nervous centres with primary normalizing effect. There may be observed improvement of functions of internal bodies. Properties of the skin improve: blood supply, metabolism, elastic properties, fat secretion and perspiration increase. There is development of biologically active substances in the skin. There is stimulation of mechanisms of the immune protection of an organism. Tolerance of the thermoreceptors increases lowering their sensitivity to cold influences. Permeability of the tissues increases resulting in resorption of infiltrates and fresh adhesions.

Massage of the lumbar region promotes improvement of the renal blood flow and reduces the general arterial pressure; it improves blood circulation

in the zone of the spinal cord radices, in the field of the ligamentous apparatus and in the tissues around intervertebral disks. Under the influence of massage the reticuloendothelium function increases, blood circulation in muscles, their trophicity improves. Massage increases lability of the neuromuscular apparatus.

After massage of the arms, thorax, collar zone of patients parameters of the phonocardiogram improve. Massage of the segmental-reflex zones in patients with diseases of the peripheral vessels improves parameters of arterial oscillography and rheovasography.

Short active massage (5–10 min) excites the nervous system, and prolonged one makes it tired. Long sparing massage intensifies processes of inhibition, causes sensations of drowsiness. Massage of the collar zone improves cerebral circulation, relieves headaches. Massage of the thorax in subacute processes can promote resorption of the residual signs of inflammation in the respiratory organ tissues with prevention of development of the adhesive process.

Circular stroking of the skin, rubbing of the tissues in the heart area diminishes pains in angina pectoris. Massage of the spine influences activity of the internal bodies. Vigorous massage of the heart area, vibrating massage between the scapular area, etc is made in collapse of the cardiac activity.

Manual massage is made by means of methods of stroking, rubbing, petrissage, tapotement and vibrations. All these methods can be carried out with different force and duration. Therefore it is necessary to distinguish sparing massage, moderate and strong. Their choice depends on the constitution, physical condition of the patient, and stage of the disease. For example, sparing variants of massage are administered in aggravations of a painful syndrome. Certain rules are characteristic of a classical variant of massage:

— massage movements are made mainly in the direction of the flow of the venous blood and lymph (it is made from distal parts to proximal ones on the extremities);

— during the procedure there is usually a gradual intensification of the massage influences — from stroking to petrissage and vibrations;

— duration of the procedure of local massage ranges from 8 to 12 min, and general — 20–30 min;

— procedures can be made daily or in a day, from 10 to 20 procedures for the course;

— in manual massage it is possible to apply talc or various oils, creams which do not irritate the skin.

***Medical effects:*** sedative, anesthetizing, tonic, trophotropic, normalizing arterial pressure (depending on the technique), immunostimulating, lymphodrainage.

***General indications:*** osteochondrosis of the spine beyond the phase of sharp exacerbation of a painful syndrome, polyarthritis, polyarthrosis, gout, arthritis, arthrosis, consequences of fractures of the extremities, diseases of the peripheral nervous system, neurosis, migraine, flaccid and spastic paresis and paralyses, diseases of the respiratory organs (bronchitis, bronchial asthma beyond the phase of exacerbation, pneumonia), obesity, diseases of the digestive organs (gastritis, enterocolitis), diseases of the urinogenital system (prostatitis, peri- and parametritis), exhaustion, asthenic conditions, etc.

***Basic contraindications:*** pyoderma, fungal diseases of the skin, fever conditions, acute infectious diseases, exacerbation of chronic diseases, tendency to bleedings, malignant neoplasms, cardiovascular insufficiency of II–III degree, lymphangitis, obliterating thromboangiitis, causalgia, damages of the integuments, pronounced varicose veins.

***Apparatuses:*** for underwater shower-massage Tangentor-8, Baby's device, various devices for vibromassage (model VMP-1, Tonus-2, models EMA-1, EMA-2M, Vitaphon, Skit, Relax, Biom-Volna, Relax-M, Vibromatic, etc.). Massage complexes: OMK-2 EPS, Multimatic, etc. There are also special massage devices for point, periosteal, connective tissue and other kinds of massage (Fig. 11, 12).

Devices of pneumatic wave massage —APVM-1 and-2 are applied in edemas of the extremities of various etiology, for prevention of development of congestion and thrombosis in the extremities, in rehabili-

*Fig. 11.* Tables for massage Terapeuta

*Fig. 12.* A rehabilitation bed BTL-1200

tation programs in consequences of traumas of the extremities and spine, in peripheral neuritis and polyneuritis.

Techniques of massage essentially differ depending on the kind of massage and the equipment applied. There are computerized massage armchairs.

## 6.2. Manual Therapy

Manual therapy means a complex of the manual manipulations which are carried out by the expert-physician, directed at elimination of the functional disorders in the area of the spine and joints. They can be vertebra displacement (incomplete dislocations, incarceration of the nerves, vessels, meniscoids and capsules of the joints, especially intervertebral ones), functional blockade of the joints.

The purpose of manual therapy is elimination of orthopedic, neurological and visceral manifestations of the spine, osteochondrosis as well as elimination of orthopedic disturbances in functional pathology in various joints of the extremities.

There are five degrees of functional condition of the joints: 0 degree — ankylosis of the joint; I degree — a heavy block; II degree — a mild block; III degree — normal mobility; IV degree — hypermobility.

Manual therapy is indicated mainly in II degree *of functional disorders* in the spine and joints. In 0 and IV degrees it is completely contraindicated, and there is no sense in it in III degree. In I degree — manual actions are given with great care. There are scores of methods of manual therapy (up to 100).

Manual therapy can be contraindicated in various diseases of the spine, spinal cord and cardiovascular system. In particular, it is contraindicated in myelopathic syndromes of spine osteochondrosis. It is most indicated in the first stages of development of osteochondrosis, in acute phase of development of a painful syndrome, and also in I stage of osteoarthrosis.

***Medical effects:*** analgesic, antispastic, trophotropic, eliminating displacement of articulate surfaces and functional blockade of vertebral segments.

*Key rules of carrying out manual therapy are the following:*

1. Before carrying out mobile manipulations it is recommended to carry out the moderate warming of the tissues of the spine or joints, their massage.

2. Manual therapy is made especially cautiously when radiological, neurological and vascular syndromes are more pronounced.

3. Manual therapy should not give enhancement of painful sensations neither during, nor after procedures.

4. Manipulations in manual therapy always begin with those sites of the spine where the pain and blockade are less pronounced or absent.

5. Achievement of the best result at the least efforts of the expert.

6. Manipulation on one segment in a significant painful syndrome should not be repeated more often than once in 3–4 days, especially in manipulations in the area of the cervical part of the spine. In the subacute course or in moderate expressiveness of pain procedures may be given daily or in a day.

7. To achieve the necessary result in acute cases 2–3 procedures can be sufficient. In the chronic cases the course of treatment may consist of 10–15 procedures and more.

8. After a session of manual therapy rest is expedient, it is possible to make immobilization by a corset, collar or special belt. The confinement to bed within several days is also possible.

9. Efficacy of manual therapy increases in its combination with methods of physiotherapy.

## 6.3. Vibrotherapy

Vibrotherapy is a medical influence by low-frequency mechanical fluctuations of different frequency and amplitudes which are carried out in contact of a vibrator surface with the tissues or through water. Point vibration of BAP (puncture vibrotherapy) which exerts mainly analgesic and trophotropic effects is possible.

Vibration influences are exerted at frequencies from 10 up to 200 Hz, with amplitude from 0.1 up to 5 mm. Application of vibration at lower frequencies (10–50 Hz) and relatively high amplitude (2–5 mm) gives trophotropic effect, intensifying the peripheral blood circulation, changing a muscular tone, increasing permeability of the tissues and activating metabolism. Vibration at frequencies of 80–200 Hz with amplitude of 0.1–1 mm has mainly anesthetizing effect. Vibration procedures can be stable (without displacement of the vibrator) or labile, influencing different zones.

***Medical effects:*** analgesic, stimulating, tonic, vasodilating, metabolic, resorption.

***Indications:*** diseases and traumas of the locomotor apparatus, organs of respiration and digestion, female sexual organs, peripheral nervous system. Vibrotherapy is more often applied in chronic processes or in the rehabilitation periods. It is also used in medical cosmetology.

***Contraindications:*** The acute period of a trauma or disease of the osseomuscular system, marked osteoporosis, a severe painful syndrome, vibration disease, thrombophlebitis, marked edemas of the tissues, infected trophic

ulcers, bed sores in the zone of influence, Raynaud's disease and syndrome, obliterating atherosclerosis, purulent processes.

***Dosage:*** parameters of the procedure are chosen depending on the character of a pathological process, the area and site of influence. In a stable technique duration of the procedure makes more often 1–2 min, in labile — taking into account the area and several zones of influence — till 10–15 min. The procedures can be administered daily or in a day, 10–12 procedures for the course of treatment.

***Apparatuses:*** Vibromassazh, Skat, Tcharodei, Tonus-2 and -3, MVT, Vitaphon, VMP-1, Mebex-3, etc. There are devices for dry and water vibromassage.

Vibrotherapeutic devices can have special purpose for cosmetic procedures on the face and neck, for the spine, feet in flat-foot, mainly for sick joints, for abdomen in obesity. There are also mixed designs: vibrotraction, vibrothermotraction, vibroacoustic and others.

## 6.4. Barotherapy (vaccum barotherapy)

Barotherapy is a method in which the air or some gases (carbonic gas, oxygen) under the increased or lowered pressure is applied with the medical purpose, mainly locally.

For local barotherapy there may be used simple medical cups, including the form of the cup labile massage, special chambers of various size and design (Kravchenko's pressure chamber, Spilt's, Aloder-4 A, etc.), dosed vacuum applicators, air cuffs with air pressure fluctuating in them. Long manual and foot cuffs which are gradually filled with air under the increased pressure from periphery to the centre are mainly used during the procedures in oncological rehabilitation practice — there is pressing out of the edematous liquids and blood from the peripheral lymphatic vessels and veins (pneumopressure). This method is applied in lymphatic-venous insufficiency in the lower extremities. There are devices with small circular cuffs in which pressure of air changes in beat pulsations. These devices (of Sinkardon type) are basically applied in patients with obliterating diseases of the peripheral vessels. Playing a role of the peripheral heart they enhance blood filling of the arterioles and capillaries in the tissues of distal parts of the extremities.

In local reductions of atmospheric pressure permeability of the tissues increases, there may be rupture of walls of the skin capillaries, and punctuate interflow haemorrhages (petechia) develop on it. Biologically active substances are formed which being resolved exert a stimulating influence on regeneration of the tissues and other reparative processes in an organism.

These signs are observed in application of medical cups and various vacuum applicators with the dosed reduction of the atmospheric pressure.

Saturation of the superficial layers of the skin, and then of deeper tissues with oxygen increases in elevation of the atmospheric pressure. It is useful to carry out procedures with carbogene in local chambers that result in hypermicrocirculation and relief of ischemic processes in the peripheral tissues.

Besides an important role is played by developing viscerocutaneous reflexes, changing the blood flow and metabolism processes in deep tissues and internal organs.

While using chambers of Kravchenko fluctuation of the air (gas) pressure can be with the increase by 2.7–4 kPa (20–30 mm Hg) and reduction by 4–13.3 kPa (30–100 mm Hg). Duration of the procedure is 10–30 min, 20 procedures for the course is given daily or in a day. Within the limits of one procedure there may be 2–4 changes of pressure quantity. It is recommended first to reduce pressure, and then to increase it.

Medical cups are applied to the trunk depending on the diagnosis of the disease: all back (10–12 pieces), along the spine (8–12 pieces), in the collar zone (6 pieces), etc. Duration of the procedure is 10–20 min, in a day or in two days on the third one. From 2–3 up to 6–8 procedures are recommended for the course (Fig. 13, 14).

***Medical effects:*** vascular regulation**,** resorption, stimulating regeneration of the tissues, analgesic, massage, lymph drainage.

*Fig. 13.* Vacuum therapeutic unit BTL Vac


*Fig. 14.* Vacuum massage unit InVacMed

***General indications to barotherapy:*** obliterating diseases of the peripheral vessels, Raynaud's disease and syndrome, osteochondrosis of the spine with neurological syndromes, pneumonia, bronchitis, cerebral hypertension liquor and venous syndromes, parodontosis-parodontitis, postoperative edemas of the extremities, etc.

***Contraindications:*** sepsis, local purulent processes, malignant neoplasms (before excision), pyoderma, pronounced varicosis, thrombophlebitis, lymphangitis, etc.

***Equipment and devices:*** Kravchenko's device, Spilt's pressure chamber, Kulazhenko's apparatuses, medical cups, inflatable cuffs, etc.

## 6.5. Traction of the Spine and Large Joints (medical traction)

Traction of the spine and large joints is carried out in osteochondrosis of the spine backbone and osteroarthrosis of I and II stages.

Traction of the spine is made by various methods and with different equipment. It is possible to distinguish conditionally dry and water kinds of traction, traction by a body weight and with weight. Traction is carried out in warm fresh and mineral waters. There are traction computer tables. Cervical and lumbar parts usually undergo traction separately. Variants are possible when traction influences the chest and lumbar parts of the spine though traction of the former one is least studied.

The mechanism of action is rather difficult: the anatomical structure of the spine is somewhat restored, its pathological curvatures are partially straightened; incomplete dislocations of the vertebra and incarceration of the intervertebral joint capsules are eliminated. It is possible to reduce the size of hernias of the intervertebral disks due to displacement of the soft

nucleus substance in the cracks of the fibrous ring. They can also calcify or resolve. In traction microcirculation in the tissues of the spine improves, vertebral pressure on the ligamentous apparatus, radices and vessels passing through the intervertebral apertures decreases. All this is possible in observance of adequate conditions of traction: the correct position, corresponding size of weight, (corresponding to the part of the spine, condition of the patient and number of the procedures — as a rule the weight is gradually increased during the course of treatment).

In traction of the spine in patients with osteochondrosis it is necessary to observe the rule: the more marked radiological changes and neurological semiology (sensitivity disorders, reduction and loss of tendon and periosteal reflexes are more pronounced, muscular atrophies) the less traction is indicated and the more carefully it is made. It means that in marked deformations of the vertebrae, destructions of intervertebral disks and significant neurological pathology traction can be contraindicated, in particular, in spondilogenic myepathology.

***Methodical variants of traction:*** it is possible to make vertical traction of the lumbar part of the spine without weight during hanging on any crossbeam for 2–5 min.

Traction by one's body weight is carried out on the bed with a raised head part (by 30–40 cm), the patient being fixed to a head back of bed by straps.

In medical establishments traction is made on special tables and boards in horizontal, inclined and vertical planes, more often with weight. Preliminary warming of the back muscles is useful. It is also made in pools and baths with warm fresh medicinal and mineral medical waters.

Vertical traction of the spine is more often made in young and middle aged persons in absence of contraindications. In older persons traction is made, as a rule, in horizontal or inclined planes with reduced weight. In procedures weight is smaller in women than in men; specific features of the spine structure are also taken into consideration. In usual conditions the amount of weight in traction of the cervical part of the spine makes 1–6 kg, gradually increasing from procedure to procedure. In traction of the lumbar part weight is from 4–5 kg up to 20–25 kg (and according to some authors — up to 50–60 kg). There are devices of gradually automatically dosed increasing force of traction during the procedure.

There is a variant of traction of the lumbar part of the spine in free swimming in the pool; the patient is given a lifebuoy (small raft) and swimming trunks are put on him with the fixed weight.

Traction on the automated devices is carried out under special programmes. Additional medical factors are warmth and vibration. While car-

rying out the procedures and the course of the spine traction in osteochondrosis it is necessary to observe another rule: neither during the procedure, nor after it the patient should feel aggravation of pain. If the pain is aggravated, it means that either traction is contraindicated, or the wrong technique is chosen.

***Medical effects:*** analgesic, metabolic, eliminating curvatures of the spine.

***Apparatuses:*** Relax, Tra computer, etc.

## 6.6. Ultrasound and Ultrasonic Therapy

Ultrasound (US) is mechanical fluctuations of the environment with frequency from 20 kHz up to 100 mHz. In physiotherapy ultrasound is mainly used with frequencies from 0.8 up to 3 mHz (more often 0.88 mHz with wave length of 1.7 mm), there are devices with frequency of 22–44 kHz.

The value of semi-absorption layer (frequency 0.8 mHz; intensity of fluctuations decreases twice): fatty tissue — 6.8 cm; muscular tissue — 3.6 cm; bone tissue 0.3 cm (absorption of waves 15 times greater); fatty and muscular — 4.9 cm. In frequency of 2.6 mHz the value of semi-absorption layer of the latter is 1.5–2 sec.

During US influence on the tissue there is a phenomenon of cavitation, i.e. creation of passing microcavities at the place of relaxation of tissues (substance). Rupture of the tissues arises in power above 3 Wt/cm$^2$.

Ultrasound can be applied to the tissue in a continuous and pulse mode. The pulse mode is more sparing. There is also a focused ultrasound (in physiotherapy it is administered for puncture influences).

US activates atoms and molecules, US-luminescence occurs in power of 0.05 Wt/cm$^2$. It gives thixotropic effect (crushing of colloids in liquids), changes configurations of the albuminous molecules, enzymes with change of their activity. US increases permeability of the cellular membranes, stimulates microcurrents inside the cells and in the extracellular liquids, carries out microvibration and micromassage. Under the influence of US very weak warming up is observed in the tissues at the place of insonation.

In small doses US stimulates regeneration of the tissues (0.2–0.3 Wt/cm$^2$).

Peripheral therapeutic use of US increases excitability of the central nervous structures.

In mild vegetative disorders sparing US-procedures promote their normalization. The marked disorders are contraindicated for administration of US.

Insonation of the endocrine glands may cause intensification of their function. Small doses of US improve the peripheral blood circulation in its nonacute disturbances. Insonation of the kidney zone reduces the arterial pressure.

Intensive US-therapy can cause deterioration of the coronary blood circulation in patients with coronary insufficiency. US causes reduction in the number of thrombocytes in the blood. Small doses of US cause hypocoagulation effects, and high ones — hypercoagulation. US in small doses stimulates creation of a bone callous after fracture. The ultrasound (0.2–0.4 Wt/cm$^2$) administered paravertebrally reduces the increased tonicity of the bronchial muscles. In chronic bronchitis (pneumonia) US stimulates infiltrate resorption, improves external breathing. US has a weak anti-inflammatory action.

Insonation of the stomach normalizes its secretory and motor functions. The influence of US on the connective tissue is manifested by rejuvenation of its cellular structure and fibrous structures. It increases permeability of the tissues: cellular membranes, vessels, connecting tissue, giving marked resorption action. US-procedures normalize disturbed ovariomenstrual cycle, eliminate nonacute dysmenorrheal phenomena. Ultrasound is a factor of biological stimulation of mechanisms of adaptation and trophicity of an organism. Under the influence of US cellular-humoral reactions become more active with release of a complex of biologically active substances with their multilateral influence on processes of the internal media, and form complex reflex and endocrine changes with coordinating and regulating influence of the higher parts of the CNS.

***Medical effects:*** resorption, anesthetizing, neurovegetative (normalizing), spasmolytic, anti-inflammatory, desensitizing, fibrinolytic.

Influences in a pulse mode are the most effective, being in the intensity of 0.1–0.3 Wt/cm$^2$ (low destructive reaction — high physical and chemical activity).

**Indications to US-therapy:**

1. Diseases of the nervous system: radiculopathies (during aggravation — a pulse mode), neuropathy of the facial nerve, neuralgia of the trigeminal nerve, a trauma of the peripheral nerves.

2. Diseases of the locomotor apparatuses: osteroarthrosis, arthritis, ankylosing spondiloarthritis, deforming spondylosis, bursitis, periarthritis, Dupuytren's contraction, calcaneal spur, rheumatoid arthritis, myositis, tendovaginitis.

3. Internal diseases: bronchial asthma, chronic bronchitis, pneumonia, ulcer of the stomach and duodenum (without tendency to bleedings), chronic hepatitis, cholecystitis, colitis, chronic pyelonephritis and glomeronephritis (a pulse mode — 4 mc 0.2–0.6 Wt/cm$^2$ — a projection to the back, 2–4 mm to the skin zone in 10–12 sec), pancreatitis, prostatitis.

4. Gynecologic diseases: peri- and parametritis, salpingoophoritis, postnatal diseases: hypogalactia, cracks of the nipples, lactation mastitis, al-

gomenorrhea and dysmenorrhea (hypofunction of the ovaries), itching in the vagina, late toxicosis of pregnant women, infertility.

5. Surgical diseases: chronic osteomyelitis, adhesive disease, wounds with infiltrate, varicose ulcer, and early stage of whitlow development, local frostbite of I and II degrees, proctitis.

6. Diseases of the skin: local itching of the skin, neurodermatitis, local scleroderma, arthropathy in psoriasis, kelloid cicatrices, trophic ulcers.

7. Eye diseases: cicatrices, keratitis, hemophthalmia, atrophy of the optic nerve, pigmental degeneration of the retina, traumatic cataract.

8. Dental diseases: glossalgia, parodontosis, arthroses of the maxillary joints, contraction of the chewing muscles.

9. ENT-diseases: chronic tonsillitis, vasomotor rhinitis, chronic antritis, frontitis, neuritis of the auditory nerve.

***Contraindications to US-therapy:*** IHD with frequent attacks of angina pectoris, thrombocytopenia, pronounced vegetovascular disturbances, cardiac arrhythmias, septic conditions, tendency to bleedings, malignant neoplasms, local insonation in benign neoplasms, local insonation in local purulent processes. It is not recommended to insonify the area of the heart, brain, cervical vegetative nodes, and bone prominence, area of the uterus during pregnancy, zones with the disturbed sensitivity, and a zone of the mammary gland nipples.

***Methodic peculiarities of insonation.*** US-influence is exerted in continuous and pulse modes (2.4 and 10 mc), direct, indirect and combined, stable and labile. Frequency of impulses is 50 Hz.

Procedures are given through the oil medium and water (subaqueous insonation). A field of insonation is sized up to 150–250 $cm^2$. There are small — 0.05–0.4 $Wt/cm^2$, average — 0.5–0.8 $Wt/cm^2$ and great — 0.9–1.2 $Wt/cm^2$ US dosed intensity. Intensity is an amount of US-energy which passes through 1$cm^2$ of the area of the irradiator for 1 sec.

Duration of the influence on one area is 2–5 min, on the area of big joints — 8–10 min. In insonation of several areas the total duration is no more than 15 min. It is 6–8 min in segmentary insonation. Duration and intensity of insonation during the course of treatment gradually increase. The number of procedures in the course of treatment is 8–15 (up to 20). They are administered daily or in a day. A repeated course is given in 2–5 months. US-procedures are given to children beginning from 2 years (weak intensity, 2–3 min on one area, the pulse mode is preferable). Procedures are given in a day.

Influences on BAP are 0.05–0.1 $Wt/cm^2$, duration is 30–60 sec.

Power and intensity of US influence is more than duration of the procedure.

## 6.7. Ultraphonophoresis with Medicinal Substances

Ultraphonophoresis (UPP) with medicinal substances is a combined medical action of US and medicinal substance which is introduced by it into the tissues.

Preconditions for UPP:

— under the influence of US there is an increase of permeability of the skin, mucous membranes, and vessels;

— acoustic pressure upon the drug develops;

— microstreams inside the cells and in extracellular liquids are formed;

— activity of some medicinal substances (interferon, heparin, lidase, etc.) increases;

— sensitivity of the tissues and microorganisms to the action of medicines changes;

— there may be synergism of the mechanism of US action and medicinal substance;

— activation of the secretory activity of the sebaceous and sudoriferous glands is observed.

Medicinal substances penetrate into the skin through the sebaceous ducts (especially fat-soluble substances) and sudoriferous glands through intercellular cracks. The continuous mode of US is more often used for UPP; depth of the direct saturation of the tissues by substances during the procedure is 0.5–1 cm, and deeper in 1–2 hrs after the procedure. The maximal effect is achieved in US intensity of 0.6–0.8 Wt/cm$^2$. Duration of the procedure on one area is up to 10 min (max — 15 min). The optimum concentration of medicinal substances is 5–10%. The best solvents are lanolin and distilled water, lanoline-vaseline mixture is also used. The ointment form is the best. The most permeable skin is on the stomach and thighs. Direct and segmentary techniques of UPP are used with 10–12 procedures for the course. The amount of medicinal substance penetrating into the skin makes 1–5% of the dose taken.

During UPP the depot of the medicine is formed in the skin: heparin, hydrocortisone, iodine are retained till 2–3 days. The composition of medicinal substances increases in blood during 8–10–12 hrs; then it decreases.

Possible advantages of medicinal ultraphonophoresis are:

— synergism of US and medicinal substance (for example UPP with lidase);

— locality of action of US and medicinal substance;

— painlessness of procedures;

— activation of medicinal substance;

— increase of the posteffect period of medicinal substance after the procedure;

— weakening of the undesirable actions of the pharmacological agent;

— phonophoresis with a fat-soluble preparation;

— complexity of a medicinal composition.

***Requirements to UPP with medicinal substances:*** stability of medicinal substances to US, high biological and medical activity of the substance, a choice of optimum solvent for the given substance, observance of the optimum concentration, synergism of US — medicinal substance, good permeability of the medicinal substance through the skin and mucous membranes, preferably local action of the substance.

Insonation destroys or sharply changes properties of novocaine, platyphyllin, morphine, quinine, caffeine, ephedrine, phenothiazine and pirazoline derivatives, ascorbic acid (Table 3).

**Devices for US-therapy**

The serial devices, working at the frequency of 880 kHz:

— UZT-101, UZT-5, UZT-107, UZT-108F — for general physiotherapy;

— UZT-102-S — for dentistry;

— UZT-103-U — for urology;

— UZT-104-O — for ophthalmology;

— LOR-1A and LOR-3 — for ENT diseases.

The serial devices, working at the frequency of 2640 kHz:

— UZT-31 — for gynecology;


*Fig. 15.* Ultra-wave therapy unit BTL-5000 Sono

— UZT-302D — for dermatology;

— UZT-303-L — for ENT diseases;

— UZT-306 — for pediatrics and ophthalmology.

The serial devices, working at the frequencies 22–44 kHz: Barvinok-G, Barvinok-P — for gynecology and proctology, Gyneton — for gynecology, Tonzilor — for ENT diseases (Fig. 15, 16).

At present the sound at the frequency of 2–4 kHz is basically applied in diseases of the locomotor ap-

Table 3. **The medicines applied in ultraphonophoresis most often**

| The name of the medicine | Structure and form of the medicine |
|---|---|
| Aloe | Water extract |
| Analgin | a) 50% solution;<br>b) 10% ointment — 15 g of analgin and 150 g of vaseline and lanolin) |
| Anestesin | 5% ointment |
| Baralgin | 2–2.5 ml of ampoule solution is rubbed into the skin and covered by glycerin or lanolin |
| Heparin | a) officinal ointment is applied to the skin;<br>b) water solution (5,000–10,000 IU) is applied to the skin and covered by a layer of vegetable oil or lanolin |
| Hydrocortisone | 1% ointment or emulsion (5 ml of hydrocortisone suspension, 25 g of lanolin and 25 g of vaseline) |
| Interferon | The solution (1 ampoule of dry substance to 2 ml of water) is rubbed into the skin and covered by lanolin or vegetable oil |
| Medical mud | a) in native kind it is applied to the skin;<br>b) the mud solution (peloidin) is applied to the skin and covered by vaseline or the other vegetative oil |
| Lidase | 64 IU of lidase (1 amp.) is dissolved in 1 ml of 1% solution of novocaine, applied to the skin and covered by vaseline or vegetable oil. |
| Lidocaine | Emulsion: 20 ml of 2% solution of lidocaine, 50 g of lanoline, 30 ml of the distilled water |
| Oxizon | Antibiotic ointment |
| Prednisolone | 0.5% ointment |
| Sinalar | Ointment or emulsion (0.025%) |
| Euphyllinum | Emulsion of 1.5 g of euphyllinum, 20 ml of the distilled water, in 15 g of vaseline and lanoline |

paratus, peripheral nervous system and urolithiasis. The sound can be applied independently (by a device) or as the additional physical factor. In the device Vitaphon, Intraphon-1 there is microvibration and sound; in the device Magophon there is a magnetic field and sound.

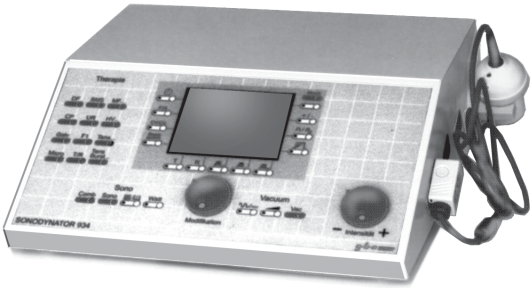


*Fig. 16.* Physiotherapeutic unit Sonodynator-934

## 6.8. Acupuncture and Acupresssure

**Acupuncture** is a medical method of influence on BAP of the skin and mucous membranes with special needles (puncture). These needles can be made of different metals (steel, silver, gold, etc.), be of different length and thickness.

**Acupressure** is a medical influence — pressure upon biologically active and hyperactive points of the skin with blunt sticks (plastic, iron, wooden) or finger tips without its damage.

Acupuncture and acupressure are individual variants of numerous ways of physical medical influences on BAP, united by the concept of physiopuncture (electric current, laser, SWF, ultrasound, vibration, cold and heat, cauterization, etc.) or puncture reflexotherapy. Over 600 BAPs are available on the skin of the person.

BAPs located on the trunk and extremities are called corporal, on the head — craniopuncture, on the ears — auricular.

There are also points on the hands and feet (mano- and podopuncture), used in one of the branches of needle reflexotherapy — Su-Jock-therapy. They are in the mucous membrane of the nose and oral cavity.

In methods of corporal acupuncture time of a needle being in the tissues depending on the pathology character ranges from 1–2 to 25–40 min. Duration of the influence on the mucous membranes is seconds. 6–10 procedures are given on an average for one course.

In acupressure time of the influence on one BAP makes 0.5–2 min.

In consecutive physical influences on some BAP total time of the procedure is extended.

In various diseases within the limits of one procedure the influence can be carried out on one point or on their numerous combinations. Selection of points for the concrete patient, and a technique of the influence are carried out by means of computer programs now.

Acupuncture and acupressure are applied, mainly, for relief or elimination of painful syndromes, but can be used in other pathological conditions.

***The basic medical effects of acupuncture:*** anesthetizing, sedative, stimulating, trophotropic, spasmolytic.

At present there is a medical speciality of acupuncture reflexotherapist in Ukraine. It is necessary to have a specialization on acupuncture in establishments of postdiploma training to get it.

## 6.9. Applicators of Kuznetsov and Lyapko

Applicators of Kuznetsov represent a plastic plate, supplied by slightly blunt pins (of plastics). The plates are sewn to linen napkins of different size. The patient can lay down on such applicators in painful syndromes in the neck, back, lumbar, and can tie this device, for example, to a joint or lumbar area.

Applicators of Lyapko are rubber plates of different sizes in which copper and iron needles are built densely in. Their penetration into the skin is limited by special rollers as well as density of location. Needles can be covered by silver, nickel, zinc, chrome and other metals. According to N. G. Lyapko, besides mechanical influence, applicators possess microelectrophoretic effect as electromotive force is created between different metals. N. G. Lyapko has also offered applicators-rollers of different size by means of which needle sliding massage can be given. The authors consider that sessions of applicator influences give general tonic effect, activate metabolism, eliminate sexual disorders in men and women, and help with treatment of various diseases of the nervous, cardiovascular, respiratory and digestive systems.

Duration of procedures with flat applicators is 10–30 min, and 5–15 min with rollers. The procedure of wearing small applicators can last from 0.5 to 3 hrs. The application of rollers and small applicators can be made 2–3 times a day.

The applicators can be applied daily, in a day, 1–2 times a week during one–three months. The technique depends on clinical features of the disease course.

***Medical effects:*** anesthetizing, stimulating, tonic, metabolic, desensitizing.

## 6.10. Fixing (Immobilizing) Devices

They include soft, semifixed and rigid corsets, collars, splints and slabs.

Corsets and collars are applied in hypermobility of the lumbar and cervical vertebrae, causing a painful syndrome. They are also used for temporary immobilization of the cervical and lumbar part of the spine after manu-

al manipulations on them. Rigid and semifixed corsets can be administered after small surgical interventions on the intervertebral disks followed by papainization or laser evaporation of hernias of the intervertebral disks. Splints and slabs are applied for immobilization of the extremities after damages of the bones, sinews and ligamentous apparatus.

## 6.11. Mechanotherapy on Special Devices

Mechanotherapy is active and passive physical exercises made on special devices with the therapeutic purpose. As a rule, it is carried out within the course of ET in rehabilitation treatment of patients after traumas and acute inflammatory processes in the tissues of the locomotor apparatus. It is applied mainly to increase scope of movements in the joints and force of muscles.

***Medical effects:*** increase in scope of movements in the joints, increase of force of the muscles.

***The basic indications:*** stable movement disorders in the joints — contractions after traumas and inflammations, pareses of various origin, weakening of the muscles after forced hypokinesia.

There are three basic kinds of mechanotherapeutic devices: pendular type, block with weight and level with inertia arising in movement.

The average duration of the procedures is 10–20 min; it is possible to repeat them several times a day. The number of the procedures is determined individually.

### Control Questions

1. Enumerate the main physical factors related to factors of mechanical nature.
2. What kinds of massage do you know?
3. What is ultrasound? What kinds of this therapeutic physical factor do you know depending on frequency?
4. Enumerate the main mechanisms of therapeutic effect of ultrasound.
5. Name indications, contraindications and age limitations for administration of ultrasound.
6. What is ultraphonophoresis?

## Control Tests

1. What therapeutic effect does local barotherapy produce:
A. Myostimulating
B. Bactericidal
C. Hemocoagulative
D. Vasoactive
E. Sedative

2. Indication for local barotherapy is:
A. Trophic ulcer of the shin
B. Varicose disease
C. Urolithiasis
D. Ulcer, stomach ulcer
E. Pneumonia

3. Local barotherapy is contraindicated in:
A. Obliterating atherosclerosis of the lower extremity, stenosis of the 1st degree
B. Thrombophlebitis
C. Osteochondrosis of the spine
D. Pneumonias in the proliferative phase of inflammation
E. Trophic ulcer of the shin

4. Normobaric hypoxitherapy is contraindicated in:
A. Iron-deficient anemia
B. Ishemic heart disease, exertional angina pectoris of I FC
C. Bronchial asthma with rare attacks
D. Disorder of the cerebral circulation
E. Osteochondrosis of the spine

5. Oxygenobarotherapy is indicated in:
A. Poisoning with carbon oxide
B. Claustrophobias
C. Acute bronchitis
D. IHD, exertional angina pectoris of III FC
E. Pneumonias

*Chapter 7*

# HEAT AND COLD THERAPY

Thermal medical influences can be conditionally divided into contact and distant. The former transmits heat in contact with the skin or mucous membranes, the latter — influences at the distance, one more influence produces heat inside the tissues. Contact heat-carriers include: warmed up paraffin, ozokerite, their mixtures (ozozhilafin), naphthalane, naphthalane mastic, medical mud, fresh and mineral waters, steam, air, sand, clay, rubber hot-water bottles and heating pads. Thermal influences at the distance are exerted by sources of infra-red (thermal) and red radiations, electric field of UHF, microwaves. Formation of heat inside the tissues is carried out by means of currents, magnetic and electric fields of high and ultrahigh frequency: currents of supersonic frequencies, diathermal current, magnetic fields of inductothermy, UHF-inductothermy, EF of UHF.

Cold medical influences can be exerted at cold agent temperatures above 0°C (medical hypothermia) and below and 0°C (cryotherapy).

## 7.1. Special Thermal Properties of an Organism of the Person

There are the homoiothermal nucleus and poikilothermal membrane in an organism of the person. The former keeps temperature of internal organs under normal conditions at a constant level +37...+37.8°C (the heart, liver, brain, etc.). The temperature of the membrane changes considerably depending on the environment temperature and, first of all, on temperature of the air and water. The poikilothermal membrane prevents the homoiothermal nucleus from overheating and overcooling. It comprises the skin, hypodermic fatty cell as well as tissues of distal parts of the extremities. The temperature of these tissues, without leading to pathology, can change within the limits of ten and a half degrees. Thermoregulation in an organism of

the person is carried out by means of mechanisms of heat production and heat emission. Heat production changes in change of metabolism intensity. Heat emission depends on narrowing or dilation of the vessels, intensity of sweating, rate and depths of respiration, muscular activity, and posture of the person. Heat emission is carried out by thermal radiation (IR-rays and millimetric microwaves), heat conductivity (contact warming up of the air, water, skintight fabrics), evaporation of moisture and sweat. It should be taken into consideration that in warm and hot water procedures heat emission is regulated only by heat radiation as sweat is washed off and the temperature of water is above the skin temperature. There can be overheating of an organism, especially in small children. Under conditions of cold influences heat emission decreases due to narrowing of the skin vessels and termination of sweating.

Thermal medical procedures can be carried out in weak thermal (oligothermal), thermal dosages and with overheating of the tissues (local and general hyperthermia). Procedures can be given with gradual increase of thermal influences and under the influence of contrast temperatures, for example, in water baths — in one bath water is with the temperature of 39–40°C, and in another one — 15–25°C.

Thermal medical influences can be general, local and segmental reflex. They can be only thermal or with the use of chemical substances: mineral and medicinal baths, use of ozokerite, ozozhilafin, medical mud, etc. Thermotherapy may have thermal, mechanical, chemical and psychotherapeutic mechanisms of action.

## 7.2. The Mechanism of Medical Action of Thermal Procedures

The thermal procedures action consists in the following:

— improvement of the blood circulation, including elimination of the ischemic signs: cerebral, cardiac, visceral and peripheral;

— spasmolytic effect, local and at the distance (transmission of heat by blood, reflex changes of the blood circulation);

— increase of permeability of the tissues, giving dissolution effect;

— activation of phagocytosis, production of interferon and antibodies;

— reduction in vital activity of thermolabile microorganisms, including pneumococci, gonococci, viruses (especially in hyperthermia);

— activation of metabolism which, in particular, is used in struggle against excessive weight;

— decrease in arterial pressure (effective in complex therapy of essential hypertension);

— analgesic effect;
— desensitizing action, especially in water-thermal procedures;
— sedative effect in moderate and weak thermal influences;
— sudorific effect with excretion of toxic substances from an organism (purification);
— purification of the skin and mucous membranes in water thermal procedures;
— dehydration of the tissues in dry thermal influences;
— stimulation of regeneration of the tissues;
— stimulation of activity of various organs and, in particular, the endocrine glands (for example, warming up by microwaves of adrenals in systemic inflammatory processes);
— activation of production of biologically active substances in an organism;
— increased absorption of chemical medicinal substances through the skin (mineral and medicinal baths) in mixed thermal procedures;
— in local hyperthermia — destruction of the tissues of malignant tumours.

The mechanical part of action of thermal procedures is manifested in various water, mud, ozokerite and other influences. Inadequate use of heat can lead to burns, heatstroke (uncontrollable hyperthermia), local dyscirculation, collapse, condensation and increase of blood viscosity and other complications.

## 7.3. Indications and Contraindications to Application of Thermal Medical Influences

**Indications:**

— various kinds local ischemias and, in particular, migraine and migraine-like syndrome, IHD, obliterating diseases of the peripheral vessels as well as Raynaud's disease and syndrome;
— essential hypertension in I and II stages, symptomatic arterial hypertensions;
— spasms of smooth muscles of the gastrointestinal and urinary tracts (in particular, warm baths in attacks of cholelithiasis and urolithiasis);
— various painful syndromes and, in particular, traumatic (beginning from the second day after trauma): neuralgia, neuritis, plexi- and radiculopathy;
— nonpurulent infiltrates;
— chronic generalized and systemic inflammatory processes (polyarthritis, polyneuritis, etc;), in particular, hyperthermia is used here;
— neurosis with increased excitability of the CNS;

— consequences of frostbites (sparing, soft heat);
— obesity.

**Contraindications:**

— malignant neoplasms;
— systemic diseases of the white blood, polycythemia, erythremia;
— sepsis and plural purulent foci;
— bleeding;
— cardiovascular insufficiency of II and III degrees;
— pronounced edema of the tissues;
— pronounced hypotension;
— active progressing forms of tuberculosis.

## 7.4. The Mechanism of Medical Action of Cold Procedures

The cold procedures action consists in the following:

— reduction of the blood circulation (with possible subsequent reactive hyperemia);

— decrease in permeability of the tissues that results in antiedematous effect;

— decrease in intensity of metabolism and, as a consequence, abatement of local inflammatory processes;

— angiospasm weakens or stops bleeding;

— analgesic effect;

— increase of peripheral resistance — normalization of arterial pressure in hypotension;

— short-term weak or moderate cold effects exert tonic influence on the nervous system, and long-term ones lead to intensification of inhibitory, sedative effects;

— decrease in sensitivity of an organism to cold, tempering is based on it;

— activation of ways of the immune protection of an organism;

— intensification of formation of biologically active substances in the skin;

— stimulation of regeneration of the tissues;

— formation of brown fat and hypodermically-fatty cellular tissue, being energy reserve and additional protection against cold influence.

Inadequate cold influences result in chilliness and frostbite of the tissues, the increased sensitivity to cold, cold angiotrophoneurosis (acrocyanosis, Raynaud's syndrome, trench foot, etc.), hypertonic crises and attacks of angina pectoris. Cold medical procedures can be carried out in weak cold

and extremely cold modes. In Japanese cold medical chambers the temperature of the air can go down up to 160–180°C (more often up to 120°C). Duration of medical sessions makes from 10 up to 90 sec.

***The main medical effect*** of these procedures consists in the subsequent long hyperthermia during which physiotherapy exercises are made.

They are applied mainly in systemic rheumatic diseases.

## 7.5. Indications and Contraindications to Cold Medical Influences

**Indications:**

— acute inflammatory processes (pancreatitis, encephalitis, etc.);

— acute trauma of the tissues and organs on the first day;

— various kinds of hyperthermia, including heatstroke (cold damp wrappings, cold on the head);

— hypotension conditions;

— various kinds of bleedings: nasal, esophageal, gastric, intestinal, uterine;

— rheumatic affections of the joints;

— burns of the skin (special chambers with cold sterile air);

— epileptic status (cooling of the head).

**Contraindications:**

— a stable picture of frostbite of the tissues;

— pronounced hypertension (high figures);

*Fig. 17.* Kryotherapy unit Kryotur-600

— tendency to frequent attacks of angina pectoris;

— Raynaud's disease and syndrome, acroangiotrophoneurosis;

— tendency to angiospasms.

**The main cold agents:** cold water (0... +20°C), ice, cold air (below 18°C), the cooled carbonic gas, chloroethane and special cold packages, cold devices: Yatran, Hypotherm-1, Hypospast-1, Germod, Kryoelektronika ALT-02 (for cooling of the stomach), Inei-2, Lindo CE, Kryotur 600, Kryoflow and other cold chambers for general hypothermia (Fig. 17).

## 7.6. Separate Kinds of Thermotherapy

### 7.6.1. Ozokerite therapy

Natural ozokerite (from Greek — *smelling wax*) is a complex firm substance of oil origin. Its structure includes firm hydrocarbons (ceresin, paraffin), mineral oil, pitches and asphaltenes. Ozokerite stick is isolated from vein ozokerite possessing antibiotic action.

Borislav deposit of ozokerite is the largest in the world. Medical ozokerite is made of ozokerite ore, which structure includes 30% of natural, 50% of petrolatum (a product of oil refining) and 20% of paraffin. Ozokeralin (ozokeritol) is used for cavity procedures consisting of 40% of vein ozokerite and 60% of vaseline oils.

In almost all modern publications, the authors mean medical ozokerite (instead of melted vein one) and its application by using words ozokerite and ozokerite therapy. We also use it in this meaning.

Latent heat of ozokerite hardening is considerably higher than in other medical heat-carriers (paraffin, silt and peat mud), hence, on the whole heat emission of ozokerite is greater than in them (Table 4). On the other hand, its low heat conductivity promotes slowed down and long heat emission. Slowed down heat emission of ozokerite, warmed up to 50–60°C, does not cause sharp responses in an organism, increasing gradually; it allows the patients with cardiovascular diseases to tolerate procedures well. Their duration in ozokerite therapy is greater than in various kinds of peloid therapy (45–60 min). The temperature of melting is 50–60°C (50–55°C).

Ozokerite renders dissolving, anti-inflammatory, anesthetizing and antiseptic action. The action of ozokerite is not limited to thermal effect. Water extracts from ozokerite while influencing the isolated heart of a frog give marked parasympathetic effect, sharply reduce sensitivity of swimming membranes of frogs, promote dilatation of the capillaries with intensifica-

Table 4. **Thermal properties of ozokerite and other heat carriers**

| Peloids | Average specific heat, cal | Coefficient of heat conduction | Relative heat-preserving ability |
|---|---|---|---|
| Well decomposed peat | 0.80 | 0.0011 | 2.10 |
| Clay | 0.50 | 0.0017 | 1.33 |
| Silt mud | 0.50 | 0.0020 | 1.00 |
| Paraffin | 0.77 | 0.0006 | 3.31 |
| Ozokerite | 0.80 | 0.0004 | 5.21 |

tion of the blood circulation, and also change skin reactivity. These experimental materials have convincingly shown possibility of chemical influence of ozokerite and have been used for a substantiation of using ozokerite applications in patients with obliterating endarteritis.

Medical ozokerite as a therapeutic heat-carrier is widely spread in medical establishments of Ukraine, especially in Prikarpatye and Zakarpatye regions. As applications of ozokerite are well-tolerated, they have prolonged soft thermal effect and minimal contraindications — all this allows to use it widely in diseases of the locomotor apparatus, nervous system, digestive organs and urinogenital system, especially in patients of advanced age.

**Techniques of ozokerite therapy**

*Ozokerite gauze compresses.* 8–10 layers of gauze are sewn together and make linings according to the area of the skin on which ozokerite will be applied. Linings are put into the melted ozokerite, wrung out, cooled in the air before formation of the crust and applied to the skin. The second lining — a hotter one (50–60°C) is put on the first lining. An oilcloth and a quilted jacket are put over the last one. The compress is fixed with a bandage.

*Cuvette-application method.* The melted ozokerite is poured into tin cuvettes 20×40 cm in size covered by an oilcloth in a layer of 4–5 cm. Ozokerite is cooled up to 45–48°C, taken out together with the oilcloth and applied to the necessary part of a body. The oilcloth is put over it. A heater (a quilted jacket, cotton blanket) is put over it.

*Method of layering.* Ozokerite melted up to temperature not above 55°C is applied by a flat painting brush to the corresponding area of the skin preliminary greased with vaseline, cod-liver oil or any other indifferent ointment. To apply the following layers use ozokerite of higher temperature (70–80°C). After application of 1–2 cm in thickness, it is covered with the oilcloth and wrapped up with a blanket or a special quilted jacket.

*Covering method.* The small bags made of the oilcloth are filled in with ozokerite of the temperature 55–60°C. Extremities of the patient are carefully greased with ozokerite of the temperature 50–55°C, and then dip them into melted ozokerite. It is hyperthermal medical procedure.

*Vaginal tampons.* First prepare balls of cotton wool and gauze stitched by long threads. The tampon is moistened in the sterilized liquid — ozokeraline, cooled up to 55–60°C, cooled a little more and introduced through a speculum into the vagina, leaving it there for 20–45 min. It is possible to introduce about 3–5 tampons simultaneously. They are pulled out by threads hanging down outside, after termination of the procedure. Ozokerite tampons are administered in a day (the course of treatment is usually 10–12 procedures). Introduction of tampons is often combined with applications

of ozokerite to the bottom of the abdomen and lumbar region. Experience has shown expediency of using ozokerite tampons in inflammatory diseases of the female sexual organs.

Indications to the use of ozokerite applications are similar to those for mud therapy. The only difference is that applications of ozokerite are better tolerated and they can be administered to weakened and seriously ill patients.

### 7.6.2. Paraffin therapy

Paraffin is a mixture of firm carbohydrates of methane. It is obtained by special processing of some variety of oil, in dry processing of brown coal and peat as well as slates. Depending on the degree of purification there are highly purified and crude paraffins.

Only highly refined varieties of paraffin (GOST 782-42) of white or slightly yellowish colour are used in medicine. Completely dehydrated paraffin is administered. Before its reuse it is melted by heating up in a water bath up to the temperature of 80–100°C.

Techniques of paraffin applications can be the same as in ozokerite therapy; however cuvette-application method is more often applied, but paraffin cools down more quickly, therefore the time of procedures is a little bit shorter (Fig 18).

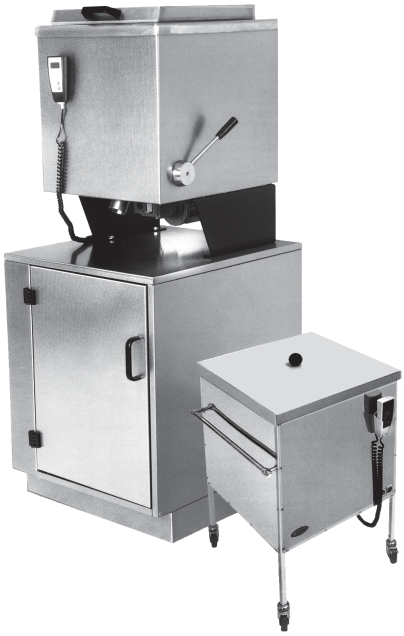

*Fig. 18.* The device for warming of therapeutic mud, paraffin, etc.

### 7.6.3. Naphthalane Therapy

Naphthalane medical oil (naphthalane) is dense black-brown liquid; it almost does not differ from other kinds of oil (heavy). However, naphthalane noticeably differs from usual varieties of industrial oil by its physical and chemical properties. There are almost no light fractions (high specific gravity) in its structure.

It is highly resinous, with small contents of sulfur, paraffin-free oil. It has rather high viscosity and ad-

hesiveness. Medical properties of naphthalane are associated with presence of polycyclic naphthalane carbohydrates, the nitrogenous bases and compounds containing sulfur in its structure. It has acid reaction caused by presence of naphthenic acids (1–3%). Nitrogenous compounds in experiment have a vasodilating effect, reduce the arterial pressure, and increase urinations.

The structure of some substances of naphthalane oil is similar to that of steroid and some other hormones.

**Naphtharesin:** a plastic preparation, its structure contains naphthalane oil (20%), paraffin (70%), ceresin (5%), camphor (1%), and wax (5%). The temperature is 50–60°C, duration of the procedure is 20–30 min, 15–20 procedures.

### 7.6.4. Clay therapy

Clay is very variable, but some varieties forming plastic mass with water, are used for clay therapy: it contains from 40 up to 70% of silicon oxide and 10–35% of aluminium oxide. Naturally occurring clay has a significant moisture capacity. Humidified clay comes nearer to silt mud in thermal capacity.

Oily clay is used for medical purposes having greater viscosity and plasticity, free from admixtures. For this purpose it is sometimes dried up and sifted through a sieve (apertures of 2–3 mm). Before application clay is mixed with fresh, mineral water or 10% solution of table salt up to a consistence of dense plastic mass. Then it is warmed up in a water bath up to 60°C. To get lower temperatures the warmed up mass is mixed with non-warmed one.

*Clay application technique:* clay warmed up to the temperature of 42–46°C is applied to a body in a layer of 4–5 cm, covered with a bedsheet (canvas), oilcloth, and blanket. Duration of the procedure is 20–30 min, 15–20 procedures for the course of treatment. It is possible to apply applications of lower temperatures (sparing techniques). After each procedure clay is thrown away. It is suggested to mix clay with the crushed organic substances (grass, seaweed) and with mineral water — a variant of artificial mud. Mixtures of clay with medical mud (5–7–10%) are also prepared.

### 7.6.5. Treatment with warmed up sand (psammotherapy)

Local and general sand procedures and baths are known. For local procedures the sand warmed up to 50–55°C is applied in small linen bags to a corresponding part of a body of the patient. Duration of the procedure is 10–40 min, 10–15 procedures.

General sandy baths are given either on sandy beaches of southern resorts, or sand is warmed up to 45–50°C and poured out into a bath or a special bed with a layer of 5–10 cm. The patient lies down on warmed up sand, and more sand of the same temperature is added, covering the whole body of the patient. Dry warm or hot sand absorbs well the sweat stood out in warming, facilitating patient's tolerance of procedures. Duration of general sandy baths is 15–20 min, 8–10 procedures for the course. They are applied, mainly, in diseases of the locomotor apparatus, peripheral nervous system and respiratory organs.

## Control Questions

1. Enumerate the basic types of contact therapeutic heat-transfer agents.
2. What forms of apparatus physiotherapy have the predominant thermal therapeutic effects?
3. What is the mechanism of action of the thermal procedures?
4. Name indications to thermotherapy.
5. Name the temperature of warm and hot water.
6. Enumerate the basic forms of refrigerants.
7. What is the mechanism of action of the cold procedures?
8. Name the temperature of cool and cold water.
9. What are indications to general and local therapeutic hypothermia?

## Control Tests

1. Indicate a difference in the therapeutic effect of ozokerite from the effect of paraffin:
A. Different temperature of tissue heating
B. Different duration of the therapeutic effect
C. Additional effect of the chemical factors
D. Additional effect action of the biological factor
E. No differences

2. What physical methods are related to the thermotherapy?
A. High-frequency magnetotherapy
B. Paraffin therapy
C. Infrared irradiation
D. UHF-therapy
E. Amplipulse therapy

3. Indicate the therapeutic effect of ozokerite therapy:
A. Sedative
B. Hemocoagulative
C. Sudorific
D. Reparative-regenerative
E. Vasoconstrictive

4. Give indications for paraffin therapy:
A. Acute pneumonia
B. Trophic ulcer
C. Gastritis
D. Liver cirrhosis
E. Acute bursitis

5. Forbidden localization of paraffin therapy is:
A. Skin
B. Face skin
C. Vagina
D. Open wound
E. There is no forbidden localization among those indicated

*Chapter 8*

# BASIC NATURAL MEDICAL FACTORS (FRESH AND MINERAL WATER, MUD AND CLIMATE)

## 8.1. Balneotherapy

**Hydrotherapy** is a medical application of fresh waters outside and inside. According to the WHO definition, *fresh water* is water with general contents of salts from 0.5 up to 1.5 g/l, containing no biologically active substances in the increased quantities. Fresh waters are administered with the therapeutic purpose in the form of baths, showers, damp wrappings, douches, rubdowns, compresses, procedures in pools (hydrokinesitherapy, traction of the spine, etc.), in baths (a sauna, a steam bath); there are techniques of drinking fresh water in some cavity influences: hydromassage of the gums, stomach lavage, etc. For example, drinking of cold water or swallowing of ice on an empty stomach: in constipation, acute pancreatitis, gastric bleedings; drinking of warm water in 40–60 min after the meal: in hypersecretory and hypermotor (spasms) conditions of the stomach — the syndrome of the angry stomach. Steam inhalations are also useful in diseases of the respiratory tracts. Fresh water of different temperatures is applied outside and inside depending on the character of a pathology: cold water — below +20°C, cool — +21...+32°C, indifferent temperature — +33...+35°C, warm — +36...+39°C, hot — above 39°C. For external medical procedures water with temperature above 45°C is not applied, for drinking the temperature of water should not exceed above 55°C. It is necessary to remember that in general procedures the water below 35°C cools an organism of the person, and above 36°C — warms it up. During 15–20 min the temperature of water in baths usually decreases by 2–3°C. Therefore, in water-thermal procedures in baths the initial temperature should not be below 37°C.

Baths can be general and local: for hands, feet, sedentary and for the face. There are many different designs of baths: for underwater shower-massage, vortical, pearl, vibrating, for traction of the spine (horizontal and

vertical), for underwater intestinal lavage. For contrast procedures there are steam baths, etc. There are even a number of designs for medical douches: rain, dust, and stream (circular, radial, ascending, steam, etc.). Douches can be of different temperatures, and water is given under the pressure from 1 up to 4 atmospheres. In medical establishments special hydropathic department is used for giving douches. Under the house conditions at normal pressure of water in a circuit it is possible to apply rain, ascending, lumbar and collar douches of different temperatures.

Duration of medical baths with fresh water and procedures in pools and baths ranges from 10 to 40 min depending on age of the patient, character and phase of the disease. The course of treatment consists on the average of 10 to 20 procedures. Duration of procedures with therapeutic douches changes from 3–5 to 10–15 min.

The mechanism of medical action of fresh-water procedures depends on methods and techniques used. There are thermal, mechanical, physical, chemical and psychotherapeutic mechanisms of action.

**Warm external water procedures** without strengthened mechanical influence exert sedative and anti-inflammatory effects, normalizing excitability of the central autonomic and peripheral nervous system. The elevated arterial pressure decreases, pulse and respiration slow down, the peripheral blood flow improves. The increased muscular tone decreases. Permeability of the skin increases and water can enter an organism, in particular, through sudoriferous glands as though washing it out. The metabolism quite often increases. The skin is cleared of deposits and pathogenic microorganisms. In the course application warm water procedures exert normalizing influence (trophotropic) on the condition of many organs and tissues.

**Hot external water procedures** work excitingly on the nervous system, cardiac activity and respiration become frequent, the peripheral blood flow (hyperemia of the tissues) and sweating are to a greater extent intensified. Arterial pressure undergoes phase changes: at the beginning of the procedure it can increase, then decreases. To a greater extent permeability of tissues increases and metabolism becomes more active. Accordingly dissolving action becomes more pronounced.

Mechanical influence of water is intensified in douches and vortical baths, and in underwater shower-massage. It is weakened in administration of semibaths, foamy baths and dust douches.

Favorable influence on the peripheral circulation is exerted by baths of increasing temperatures — from 33–34 up to 37–38°C for 20 min.

The general baths with water temperature increase from 36–37 up to 42–45°C cause general hyperemia and are applied in chronic systemic inflammatory processes.

***Medical effect of water-thermal procedures**:* antispastic, vasodilating, metabolic, trophic, sedative (in hot and exciting), analgesic, dissolving, detoxication.

**Cool and cold waters** as well as ice cause narrowing of the vessels, reduction in permeability of the tissues, weakening of metabolism intensity, especially in the superficial tissues, decrease of arterial pressure, the cardiac activity is accelerated. Under their short-term influence the tone of muscles and nervous system increases, but under the long one it can decrease. Cold water and ice possess analgesic action, promote bleeding cessation, interfere with development of edemas, reduce intensity of inflammation in the tissues, and stop local or general perspiration.

After short procedures with application of cold water metabolism is activated. The cold water procedures applied regularly possess immunomodulating action, increase adaptation — adaptive responses of an organism to changing and low temperatures of the environment that underlies their tempering action and decrease catching colds.

Contrast warm (hot) and cool (cold) baths and showers with a difference of temperatures by 10–25°C possess vigorous influence on hemodynamics, the nervous and immune system. Contrast of water temperatures can be variable for different diseases and patients. For the majority of adults, especially sick ones, the recommended temperature of the warm water makes 37–38°C, and cool 23–25°C. Duration of the continuous stay in the warm water at the beginning of the treatment course makes about 3 min, in cool — 1 min. Then time of stay is gradually shortened in the warm, and extended in the cool water. The general duration of one procedure in baths makes 15–20 min, and in showers — to 10–12 min. Procedures are carried out daily or in a day, 15–20 procedures for the course.

## Indications to hydrotherapy

**Diseases of the nervous system:**

— neurosis and neurosis-like conditions, mainly in hypersthenic symptoms;

— vegetovascular dystonia with the tendency to hypertension or to fluctuations of arterial pressure, respiratory and gastroenterological forms;

— consequences of traumas of the head and spinal cord, encephalitis and myelitis;

— diseases of the peripheral nervous system: neuralgia, neuritis, radiculitis and other forms of neuropathies;

— the central and peripheral neurovascular diseases with ischemic syndromes.

**Diseases of the locomotor apparatus:**

— polyarthritis beyond the phase of exacerbation of the disease and polyarthrosis;

— osteochondrosis of the spine;

— Bekhterev's disease beyond the phase of exacerbation;

— consequences of traumas of the locomotor apparatus;

— arthritis, arthrosis, myositis.

**Internal diseases:**

— ischemic disease of the heart (coronary artery disease) without frequent attacks of angina pectoris, marked arrhythmia, without signs of cardiovascular insufficiency of II–III degrees;

— myocardiodystrophy of various genesis in the phase of remission without cardiovascular insufficiency of II–III degrees;

— bronchial asthma in I and II stages without frequent asthmatic attacks, asthmatic bronchitis;

— chronic enterocolitis, gastritis, duodenitis without tendency to bleedings;

— chronic spastic cholecystitis, cholelithiasis (in particular, warm baths during painful attacks);

— chronic pyelonephritis, urolithic diseases (in particular, during salt attacks);

— obliterating diseases of the peripheral vessels;

— adiposity of I–III degrees.

**Diseases of the ENT-organs and dentomaxillary system:**

— ARD, acute rhinitis (foot hot baths, steam inhalations, sauna);

— parodontosis (hydromassage of the gums).

**Indications to cool and cold hydrotherapy:**

— neurosis and neurosis-like conditions in hyposthenic stages;

— asthenic conditions of various genesis;

— vegetovascular dystonia (essential hypotension) with the tendency to hypotension, increased perspiration;

— varicose veins of the upper and lower extremities in I–II stages;

— tempering.

**General contraindications to hydrotherapy:**

— malignant neoplasms;

— sepsis and purulent centres in the organs;

— systemic diseases of white blood;

— feverish conditions (except for cold compresses and damp wrappings in hyperthermia);

— cardiovascular insufficiency of I–III degrees;

— pronounced widespread edemas;

— frequent attacks of angina pectoris, exertional angina pectoris;
— a condition after myocardial infarction and stroke till 1 month;
— uro- and cholelithiasis with detected large stones;
— nephrosclerosis;
— cirrhosis of the liver;
— weeping dermatitis.

### Aromatic and medicinal baths

Baths are prepared mainly with fresh water with addition of aromatic substances (a coniferous extract, mint tincture, extract of almonds, etc.) or various medicines: turpentine, extract of sage, mustard, potassium permanganate, extracts from oak bark, leaves of walnuts, root of valerian, etc.

Aromatic baths exert their influence on skin receptors and in addition through organs of smell, strengthening processes of excitation or inhibition in the nervous system. They more often possess tonic effect.

Indications to application of medicinal baths are determined by medical properties of the dissolved medicines.

**Turpentine baths** possessing analgesic and anti-inflammatory action are especially useful in diseases of the locomotor apparatus and peripheral nervous system.

Baths and local small baths with potassium permanganate are applied in skin inflammatory processes and fungoid diseases.

**Aluminous and starch baths** as well as those from decoctions of the oak bark, leaves of walnuts, having astringent, tanning and anti-inflammatory effect, are effective mainly in skin-allergic diseases.

Baths with decoctions from **the root of valerian** are applied in development of a hypersthenic phase of neurosis and neurosis-like conditions (Fig. 19, 20).

## 8.2. Medical Mineral Waters

They comprise waters with the contents of salts more than 2 g/l, and also with the smaller contents of salts, but having microelements, organic substances (the contents in mg/l) or gases in increased quantities. MMW can be natural or artificially prepared.

Dominating chemical substances often determine names of waters, they are: ferriferous, iodide-bromine, arsenious, sodium chloride, hydrosulphuric, carbonic, etc. Gas waters are waters in which the distinct biphase medium water — gas — was formed. These are carbonic, nitric, oxygen gas waters. Neither hydrosulphuric nor radon waters are related to them: hy-


*Fig. 19.* Baths for hydromassage: WKG — for arms; WKD — for legs; WKS — for feet

*Fig. 20.* Salt and carbonic acid gas bath

drogen sulphide is dissolved completely, without forming the biphase medium — the volumetric quantity of radon is insignificant little.

*The basic criteria of estimation of medical mineral waters*: general mineralization, ionic (salt) structure, the contents of microelements, gases, organic substances, reaction of environment (pH), temperature of water in the spring, radioactivity, microbiological structure.

**Criteria of general mineralization, classification:**

— weakly mineralized medical waters — general contents of salts are no more than 2 g/l, but in the increased quantities there are biologically active substances — BAS (Naftusya, Berezovskye mineral waters, kvass);

— MMW of small mineralization — 2–5 g/l of salts (Kuyalnik, Mirgorodska);

— MMW of average mineralization — 5–10 g/l of salts (Luzhanska, Polyana Kupel, Polyana Kvasova, Borzomi, etc.);

— MMW of high mineralization — 10–35 g/l (Essentuki 17, Batalinska);

— brines — the contents of salts is over 35 g/l (brine of Kuyalnik and other estuaries).

MMW of small, average and high mineralization can contain microelements in the increased quantities, less often gases.

**Bottle** mineral waters are divided into three groups: table, medical-table and medical.

**Table** waters are with general mineralization up to 1.5 g/l, possessing good taste, not containing BAS in increased quantities. They can replace fresh potable water.

**Medical-table** waters are with the contents of salts from 2 up to 8 g/l. Incidentally they can be used as table ones, but their long-term application is possible only as medical. Concrete medical-table mineral water has indications and contraindications to application.

**Medical waters** are waters either with the contents of salts over 8 g/l or with their smaller quantity but including BAS in medical dosages (in milligrams or gram per liter). They are applied only by doctor's administration.

Waters are intended for external use with the contents of salts from 10 up to 80 g/l. The waters containing BAS in increased quantities may have less than 10 g/l of the salts (iodide-bromine, arsenious, hydrosulphuric, carbonic, sulphidic, etc.).

**Ionic structure.** There are waters of simple and complex structure. Simple ones contain one anion and one catione (dominate). Sodium chloride waters are an example. Waters of complex structure are two and more anions and cations. The widespread anions are: Cl, $HCO_3$, $CO_3SO_4$, cations: Na, K, Ca, Mg. The others are related to microelements. While determining the type of mineral waters the ions are considered containing in waters in quantities not less than 20 equiv.%.

**Microelements.** Threshold concentration of some microelements is determined in therapeutic mineral waters: arsenic (0.7–3.0 mg/l), iron — (10 mg/l), iodine (5 mg/l), bromine (25 mg/l), fluorine (2–5 mg/l), copper (1 mg/l), silicon (50 mg/l $H_2SiO_3$), boron (35–50 mg/l $H_2BO_3$). These microelements determine the name of some medical waters (arsenic-containing, ferriferous, iodine-bromine, fluoric, siliceous, boric, etc.).

**Gases**. *Carbonic gas* is most widespread; the minimal therapeutic concentration for intake is 500 mg/l (0.5 g/l), for external application — 0.8 g/l.

There are the following types of carbonic waters: weak carbonic waters — 0.5–1.4 g/l $CO_2$; medium concentration — 1.5–2.5 g/l $CO_2$; strong — over 2.5 g/l $CO_2$.

*Hydrogen sulphide* is the second gas by spread and application. For drinking its concentration is 10–30 mg/l, for external application — 50–400 mg/l. There are the following types of sulphide waters: weak — 10–50 mg/l; medium — 50–100 mg/l; strong — 100–250 mg/l; especially strong sulphide waters — above 250 mg/l.

The third gas is *radon*. Its minimal medical contents is 5 nCu/l (0.2 kBq/l), and in pools and baths with running water 3–5 nCu/l. There are the following types of radon concentration: very weak — 5–20 nCu/l (0.2–0.75 kBq/l); weak — 20–40 nCu/l (0.75–1.5 kBq/l); medium concentration

— 40–200 nCu/l (1.5–7.5 kBq/l); high radon — 200 nCu/l (over 7.5 kBq/l)

*The fourth gas is nitrogen.* The minimal contents are 20 mg/l.

*The fifth gas is oxygen.* Only artificial oxygen baths are applied — 30–50 mg/l $O_2$.

**Organic substances.** They can be mainly of oil or soil origin. The structure of organic substance of some waters may contain naphthenic acid, bitumen, resins, fat acids (acetic, ant), humus substances (humic and folic acids), volatile neutral compounds (ethers, alcohols), amino acids, carbohydrates. Organic carbon in medical waters may be contained: up to 10 mg/l — a moderate quantity; 10–20 mg/l — high, 20–30 mg/l — very high. Maximal admissible contents of the organic substance in therapeutic-mineral waters are 30 mg/l. In weakly mineralized waters the organic substance can play a significant role (therapeutic). It is up to 20 mg/l in Naftusya.

**Temperature of water.** Cold — below +20°C, cool +20°C... +32°C, indifferent +33... +36°C, warm +36... +39°C, hot +39... +45°C and above.

**Reaction of the medium pH** <3.5 is strongly acidic, 3.5–5.5 — acidic, 5.5–6.8 — subacidic, 6.8–7.2 — neutral, 7.2–8.5 — alkalescent, > 8.5 — alkaline. Subacidic, neutral and alkalescent waters are basically applied.

**Radioactivity** is determined by the level of radon contents.

**Microbiological structure.** Many therapeutic mineral waters have their typical structure of microbes-saprophytes.

The scheme-plan of the modern formula of evaluation of mineral waters:

$$\frac{\text{Gases}}{\text{Microelements}} \quad M \quad \frac{\text{Anions}}{\text{Cations}} \quad \text{pH; t°}$$

In the above-written scheme M — the general mineralization in grams. The contents of gases and microelements in milligrams. The contents of anions and cations in an equivalent-percent.

## Classification of medical mineral waters (basic balneological groups)

1. Waters without specific components, which therapeutic action is determined by the sum of salts of macrostructure (sodium chloride, sulfate-magnesium, sodium hydrocarbonate, etc.).
2. Carbonic waters which therapeutic action is determined mainly by pronounced contents of carbonic gas.
3. Hydrosulphuric waters (sulphidic).
4. Nitric waters.

5. Radonic waters.
6. Ferriferous waters.
7. Arsenious waters.
8. Iodine, bromine, iodide-bromine waters.
9. Siliceous waters (metasilicon acid).
10. Boric waters (borate acid).
11. Waters with the increased contents of organic substances.

All the above-stated waters are available in the nature and can be prepared artificially. Some amount of salts and microelements are as a rule in gas waters.

## General indications to mineral waters therapeutic application

Drinking mineral waters are administered mainly in pathology of the organs of digestion, kidneys and urinary tracts. Carbonic and sodium chloride waters stimulate gastric secretion and muscular tone. Therefore, they can be indicated in hyposecretory and atonic conditions of the stomach, anacid gastritis. Alkaline (sodium hydrocarbonate) waters are administered in hyperacidic gastritis, in ulcer of the stomach and duodenum. Sulfate-magnesium waters and of a Naftusya type strengthen cholepoiesis and are indicated in cystitis, cholecystitis, cholangitis and cholelithiasis.

Waters of moderate and high mineralization strengthen peristalsis and consequently they can be used in atonic enterocolitis.

Balneotherapy is an external application of MMW: baths, showers, douches, rubdowns, procedures in pools.

Various MMW are administered in different diseases. Hydrosulphuric, radonic, sodium-chloride waters are especially often applied in diseases of the locomotor apparatus, peripheral and autonomic nervous system. Hydrosulphuric baths are especially effective in diseases of peripheral vessel and skin diseases. Carbonic baths are more frequently recommended in diseases of the cardiac muscle, in hypotonic conditions. Oxygen, nitric and iodide-bromine baths are administered in treatment of neurosis, vegetovascular dystonia, essential hypertensionof I, IIA stages, ischemic heart disease (without frequent attacks of angina pectoris).

## General contraindications to balneotherapy:

— malignant neoplasms;
— systemic diseases of blood (except for some forms of anemias);
— sepsis and feverish conditions;
— essential hypertension;

— cardiovascular insufficiency of II and III degrees;
— IHD with frequent attacks of angina pectoris and recent myocardial infarction;
— stroke (up to a month from the beginning of the acute period);
— the acute periods of infectious diseases.

## 8.3. Mud Treatment (peloid therapy)

Slimy sulphidic and peat muds are widely used in resort and extraresort medical establishments of Ukraine. The mechanism of their action is associated with thermal and physical and chemical effects. Hydrogen sulphide, microelements and organic substances of muds get through the skin and mucous membranes into an organism during procedures, having therapeutic effect. Under the influence of warm and hot mud procedures permeability of the tissues increases, the blood circulation and metabolism are enhanced, processes of tissue regeneration are activated. Antibiotic substances of mud have antiseptic effect. Being adequate in temperature and durations mud procedures normalize activity of various organs and systems: the muscles, the joints, the liver, the stomach, the intestines, the kidneys, the female and male sexual organs, the nervous and cardiovascular system.

***Medical effects:*** improvement of blood circulation and microcirculation, anti-inflammatory, resorption, desensitizing, stimulating regeneration of tissues, analgesic, normalizing function.

Therapeutic muds are applied mainly at stages of restorative treatment as well as in chronic course of some diseases.

**Basic indications**

1. *Diseases of the locomotor apparatus:* arthritis, arthrosis, polyarthritis, polyarthrosis, myalgia, myositis, tendovaginitis, osteomyelitis, osseoarticulate tuberculosis, consequences of traumas of the spine, joints, bones, muscles, sinews, osteochondrosis of the spine.

2. *Diseases of the nervous system:* neuralgia, neuropathy, radicular syndrome, polyneuropathy. Consequences of encephalitis, myelitis, poliomyelitis, traumas of the head and spinal cord, peripheral nervous system.

3. *Gynecological diseases:* vulvovaginitis, peri- and parametritis, salpingooophoritis, hypofunction of the sexual glands, primary and secondary infertility, consequences of operation on female genitals for inflammatory processes.

4. *Diseases of ENT organs:* chronic frontitis, maxillary sinusitis, ethmoiditis, rhinitis, tonsillitis, laryngitis, mastoiditis, neuritis of the acoustical nerves.

5. *Internal diseases:* chronic bronchitis, gastritis, hepatitis, stomach and duodenal ulcer, gastroenteritis, pyelonephritis.

6. Fresh cicatrix-adhesive and sclerosing processes.

**Basic contraindications**

Septic and feverish conditions, all kinds of tumours and diseases of blood, polycetemia, erythremia, local purulent processes, various diseases in the phase of exacerbation, IHD with frequent attacks of angina pectoris or with exertional angina pectoris, essential hypertension of II and III stages, cirrhosis of the liver, nephrosclerosis, cardiovascular insufficiency.

**Basic methods of mud therapy**

Integral and split mud baths, applications, compresses, tampons (vaginal, rectal), mud therapy by a method of solar heating, electromud procedures, ultraphonophoresis with medical mud, mud therapy by a method of heating by infrared rays.

At the pharmacies there are mud medical products (extracts): peloidin, peloidodistillate, FIBS, humisol, etc. They, however, to a greater extent are related to therapy by biostimulators than to mud therapy.

**Basic mud resorts of Ukraine:** Berdyansk, Evpatoria, Saki, Kuyalnik, Slavyansk. Slimy sulphidic muds are used in them. Large balneological resorts, such as Mirgorod, Morshin, Truskavets, Khmelnik, apply mainly peat mud.

## 8.4. Climate Therapy

**Climate** is a long-term mode of weather development on the big area of the Earth.

**Weather** is a physical condition of the lower layers of the atmosphere in concrete geographical area at present time (during definition of the main meteoelements).

**Microclimate** is a complex of meteorological conditions in a small geographical area or in the closed premises. There are a lot of variants of artificial medical devices with artificial microclimate, the so-called climatotrons. For example, a sauna or steam bath having indications to medical application can be related to them. The climate is formed by three basic groups of factors: atmospheric, terrestrial and space.

**The main meteoelements** characterizing climate and weather: temperature, humidity of the air, atmospheric pressure, saturation of the air with

oxygen and ozone, movement of the air (wind velocity), precipitations, a condition of the atmospheric electricity (including the contents of aero- and hydroaeroions in 1 $cm^3$ of air), climates of plains, mountains, seas, seaside coast. There are also climatic zones: cold, moderate and hot.

***The following medical types of weathers are known:***

**Type I.** Very favourable weathers (with a steady course of the main meteoelements in modes favorable for the person).

**Type II.** Favorable weathers (meteoelements are mobile in the moderate limits).

**Type III.** Unfavourable weathers (with unstable course of the main meteoelements or with their extreme deviations).

Sometimes **type IV** is distinguished. Especially unfavourable weathers are: thunder-storms, hurricanes, strong blizzards, squalls.

In III and IV types of weather sick people should limit the labour loadings and undertake preventive measures in order to prevent development of crises and deterioration of the state of health.

Meteoreactions:

I degree — in change of weather — subjective deterioration of the state of health.

II degree — adverse sensations are enhanced and proved by changes of pulse rate, arterial pressure, rheovasography, rheoencephalography, electrocardiogram and other objective parameters.

III degree — signs of development of crisis conditions or progressing of the pathological process: hemoptysis, attacks of bronchial asthma, elevated AP, attacks of angina pectoris, etc.

In climatotherapy it is possible to distinguish the following forms:

— climatotherapy itself (treatment of lung diseases by mountain climate, kidneys — by desert climate, etc.);

— aerotherapy — treatment by fresh air in the dosed and not dosed forms;

— heliotherapy — treatment by solar rays in dosed and weakly dosed forms;

— thalassotherapy — treatment by sea factors (mainly sea bathings).

**Microclimatotherapy** is treatment by microclimate of natural (caves, grottoes) or artificial (hydrochloric and uranium mines, artificial climatotrones) and closed premises.

**Aerotherapy** is indicated in many diseases, but especially to patients with diseases of the cardiovascular system, respiratory organs and nervous system.

**Heliotherapy** is most expedient in diseases of the skin (psoriasis, pyoderma, wounds, ulcers, etc.), rickets, chronic diseases of the respiratory organs (bronchitis, pneumonia), neurosis, vegetovascular dystonia in mild forms.

**Thalassotherapy** is indicated in myocardiodystrophy, IHD without frequent attacks of angina pectoris and pronounced arrythmia, essential hypertension of I–II stages, neurosis, neurocirculatory distonia of the mixed type, atherosclerosis of various organs and systems, chronic diseases of the locomotor apparatus, consequences of its operations and traumas, diseases of the respiratory organs, etc.

**Contraindications to climatotherapy**

**Aerotherapy** in a broad sense has almost no contraindications. Air baths can be contraindicated in acute infectious diseases, acute diseases of the respiratory organs, exacerbation of rheumatism and others.

**Heliotherapy** is contraindicated in feverish conditions, malignant neoplasms, diseases of blood, in acute infectious diseases, IHD with frequent attacks of angina pectoris, phytodermatitis, thyrotoxicosis, etc.

**Thalassotherapy** has basically the same contraindications as heliotherapy.

**Climatic resorts of Ukraine**: Southern coast of the Crimea, Alushta, Feodosiya, the Zakarpatye resort region, Slavyanogorsk (Donetsk region).

## Control Questions

1. Give definition of hydrotherapy.

2. Give definition of balneotherapy. What is natural mineral water?

3. Give definition of therapeutic muds. What kinds of therapeutic muds do you know?

4. Name the main mechanisms of therapeutic effect of natural therapeutic factors (balneotherapy, peloidotherapy, climate).

5. Name indications, contraindications and age limitations for administration of balneo-, peloido- and climate therapy.

## Control Tests

1. How are air baths dosed?
A. By the volume of the heat emission
B. By the area of the exposed body surface
C. By the air temperature
D. By duration of the recommended volume of cold load taking into account equivalent effective temperature
E. By the body temperature

2. The leading factor in the influence of drinkable mineral waters on the organism is:
A. Thermal
B. Chemical
C. Mechanical
D. Biological
E. Thermal

3. The level of mineralization of the therapeutic mud is characterized by:
A. Content of microflora
B. Viscosity
C. Quantity of salts in the mud solution
D. Bactericidal property
E. Heat-retaining ability

4. Peloidotherapy possesses the following therapeutic effect:
A. Venotonic
B. Reparative-regenerative
C. Mycocide
D. Vasoconstrictive
E. Myoneurostimulative

5. Mud applications are not allowed:
A. To the open wound surfaces
B. To the projection of the female sex organs
C. Rectally
D. To the projection of the heart from the front
E. Vaginally

*Chapter 9*

# PHYSIOPROPHYLAXIS

**Physioprophylaxis** is a science studying application of physical factors for general improvement of the person's health (primary prophylaxis), prevention of disease development in presence of risk factors (secondary), prevention of relapses and progressing of the disease (tertiary).

For the purposes of primary and secondary physioprophylaxis water and air of different temperature, aero- and hydroaeroions, solar and ultraviolet rays, massage, normobaric hypoxia, sea water, mineral waters, curative climate, their combination with physical exercises — physiokinesiprophylaxis (climate kinesiprophylaxis) are used.

In tertiary prophylaxis all arsenal of physical medical factors are used.

Physioprophylaxis is also a system of application of physical factors for general improvement of health and prevention of various diseases.

In conditions of urbanization and general deterioration of the environment of special role is tempering leading to increased stability of an organism to influence of quickly changing temperature-climatic factors (humidity, wind, atmospheric pressure, electric condition of the atmosphere, etc.), to development of infectious diseases.

**Basic rules of tempering:**

— choice of one or several factors adequate to the condition of an organism;

— constant increase in the dose (or doses) of tempering agents;

— systematic character and regularity of carrying out tempering procedures;

— individualization of procedures and techniques of tempering;

— realization of tempering under the conditions of optimum muscular activity;

— application of general and local procedures of tempering;

**Tempering by water** is carried out more often by means of rubdowns, douches, showers, drinking water of gradually decreasing temperature from 37–38°C up to 10–12°C.

At the beginning of the course the temperature decreases by 1–2°C in 2–3 days. Then it remains stably low.

Tempering procedures also include baths, showers, dousing with water of contrast temperatures of 38–42°C and 15–20°C. Swimming in the open reservoirs can also be of use. At the beginning of the course duration of one tempering procedure is 2–3–5 min, and then it increases gradually and becomes individual.

Tempering by water can be general and local: foot baths of cool and cold temperatures; drinking of cool and cold fresh or mineral waters, washing of the nose cavity with water of gradually decreasing temperature. We may carry out tempering of an organism by all-the-year-round bathings in sea water (winter-swimming), but it is not indicated to everyone.

**Tempering by air** can be carried out in the form of the dosed air baths, walks and work in the open fresh cool and cold air.

The accepted division of temperatures of the air while taking air baths by the naked person in absence of the wind and direct influence of the sun rays, with optimum humidity of the air is: warm +22...+26°C, indifferent temperatures +17...+22°, cool +9...+16°C and cold — +1...+8°C. Tempering takes place under the influence of the air of cool, moderate cold and cold temperatures.

The cold loadings can be small, medium, big and maximal.

Books and chapters of manuals on climate therapy present special tables of calculation of cold loadings at different parameters of weather.

In resort establishments while giving mass procedures of tempering in climate pavilions and on beaches their duration is calculated by means of computers.

**Tempering by the sun rays and air** is carried out by calculation of intensity of thermal and ultra-violet influence of the solar rays by means of special tables and computer programmes.

Under the usual conditions tempering in summertime should be given in climate pavilion or on beaches of the south of Ukraine in the morning (7–10 a.m.) or before evening (16–19 p.m.).

**Tempering by heat and cool water** is given in saunas and pair baths. Dosed overheating of an organism leads to stimulation of activity of the endocrine, cardiovascular and immune systems, strengthening of metabolism, decrease of the arterial pressure, improvement of functions of the kidneys and urinary tract. As a rule, tempering in baths provides warming

up of a body in the sweating-room, and then contrast influence by cool or cold water in the pool, bath or under a shower.

The limiting temperature of the dry air in saunas is 100–110°C, and of the damp one in steam baths is 50–55°C. Duration of the first comings in the sweating room is 3–5 min with the subsequent contrast influence by water and rest. At the beginning of the course 2–3 comings in the sweating-room are recommended per one session. Later on the number of comings and sessions gradually increases.

**Walking barefoot**. One of the means of tempering is walking barefoot on cold or wet grass, cool sand, snow, cold floors and sidewalks. Walking barefoot is started on not so cold ground — short procedures for 9–10 min, and then they are gradually extended. It is useful to make a warm foot bath after walking barefoot.

Aero- and hydroaeroionization of household and industrial premises can serve to the purposes of general improvement of an organism's health (see chapter 4).

Besides natural factors, it is possible to use all arsenal of apparatus physiotherapy, especially for secondary and tertiary prophylaxis.

To increase nonspecific resistance of an organism the following methods can be offered: ultraviolet radiations of long and medium ranges (A and B), transcerebral methods of electrotherapy, general franklinization and aeroionotherapy, laser therapy, including intravenous laser irradiation of blood or transcutaneous irradiation of blood, millimeter resonant therapy, magnetotherapy, aerosol-, electroaerosol therapy with vitamins, adaptogens. Ultraviolet rays are applied for primary and secondary prevention of rickets, age-related osteoporosis, relapses and other disorders associated with solar starvation.

## Control Questions

1. Name the main principles of tempering of the organism?
2. What is called physical preventive measures?
3. What are the main methods of tempering?
4. How can be tempering by air achieved?
5. Indicate the main rules of tempering by sun.
6. How can be tempering by water achieved?
7. Name the peculiarities and rules of conducting hyperthermic influences (hothouse, sauna) for tempering.
8. Enumerate methods of apparatus physiotherapy, which maximally meet the requirement of physical preventive measures.

## Control Tests

1. The purpose of primary physioprophylaxis is:
A. Strengthening of the protective reactions of an organism
B. Tempering of an organism
C. Development of adaptation to fluctuations of the external temperature and atmospheric pressure
D. Only A and B
E. All enumerated

2. The therapeutic and prophylactic type of establishments include:
A. Tourist bases
B. Boarding houses
C. Sanatoria
D. Sanatorium-preventorium
E. C and D are correct

3. The complex programme of physioprophylaxis provides the application of physical factors with the purpose of:
A. Prevention of development of the diseases
B. Tempering of an organism
C. Increase in resistance to professional stimuli
D. Prevention of chronic diseases exacerbation
E. All enumerated

4. The condition and working ability of an organism under the effect of the therapeutic physical factors is determined by:
A. Increase in adaptation to the cold influence
B. Resistance to colds
C. Decreased fatigue
D. Increased adaptation to the reduced atmospheric pressure
E. All enumerated

5. The most effective methods of physioprophylaxis in pregnant women are:
A. General ultraviolet irradiations
B. Light and air bath
C. Hydrotherapy (douches)
D. All enumerated
E. Only A and B

*Chapter* 10

# PHYSICAL FACTORS IN PEDIATRICS

## 10.1 Peculiarities of the Children Organism Important for Physiotherapy

The peculiarities of the children organism which are important for physiotherapy are the following:

— the age of a child — physical factors are administered with differentiation, depending on the age of children (see the table 5);

— the tender vulnerable skin, more permeable for different substances than in adult (caution during electrophoresis, phonophoresis with medicinal substances);

— small mass of the child's body in combination with weakness of the thermostatic control contribute to overheating or overcooling of a child;

— rapid growth of the organism with delayed maturation of the vegetative nervous system (basic regulator), possible deviations in the development and inadequate response to the physical procedures;

— the state of the spine — in scolioses and kyphoscoliosis — massage, exercise therapy, thermal procedures and others;

— fear of the procedure — special attention of the nurse while carrying out the first procedures, the possibility of carrying out the first placebo-electroprocedures;

— increased excitability of the nervous system, excessive mobility, creating obstacles for the normal course of the procedures;

— increased convulsive readiness, which should be considered in administration of electroprocedures;

— more intensive metabolism, more rapid and more pronounced reaction of an organism to the procedure, which influences the development of physical balneoreaction;

— more intensive formation of the biologically active materials;

— incomprehension of the peculiarities of the procedure with impossibility of its correction by a sick child;

— repeated allergization of children (nourishment, medium, infection) — caution in application of physical pharmotherapy;

— the time of lactation of a child, the procedure is recommended 30–60 min after it;

— different dysfunctions as a result of radiation effect (the Chernobyl children) with possible inadequate reactions to the physical procedures.

Before administration of the course of physiotherapy to a child, it is important to find out tolerance of the previously carried out procedures, sensitivity to the drugs (in electro- and phonophoresis with medicinal substances, in medicinal inhalations and baths). The course of treatment must be individualized taking into account the sex of a child, peculiarities of the course of the disease, adaptation possibilities of an organism.

In children daily and seasonal biological rhythms are considered to a larger degree. In particular, it is recommended to administer the exciting and tonic procedures before the day sleep.

The smaller the child, the more careful should be physical procedure and course of the treatment: the duration of procedures decreases, the intensity of influence is weakened, the optimum temperature of water and mud, the selection of the least irritating factors, the concentration of biologically active materials in the baths are reduced, procedures are more frequently administered in a day (only in the acute period — daily), a quantity of components in the complex course of treatment decreases, lower-power equipment is used. Mineral waters are administered for intake during their weak or small general mineralization.

Control for tolerance of the procedures is strengthened: for the state of the skin, reactions of a child during their carrying out, the state of appetite and sleep. Great probability and manifestation of physical balneoreactions are taken into consideration.

Of special importance are the methods of nonmedicinal physiotherapy in allergic diseases in children, allowing to decrease the dose of medicines, their side effects, to contribute to hyposensitization.

The application of physical factors is limited or contraindicated if adaptation possibilities are sharply reduced in an organism, reactivity is disturbed, and there is danger of dissemination of the disease. General contraindications for applying physical factors are following: severe general condition, high temperature of the body (exception of cold procedures), acute hypotrophy, marked forms of the circulation insufficiency, dysfunction of the kidneys, diseases of the blood, increased bleeding, active tuberculosis, suspicion of the malignant neoplasm.

There may be contraindications for the applications of one factor, caused by the specific peculiarities of its action (for example, UVI — with photosensitization, electrogymnastics — with increased convulsive readiness and others).

## 10.2. Peculiarities of Administration of Physioprocedures to Children

### Hydrotherapy

The temperature of the water for children (in the baths, douche): cold — lower than 28°C, cool — 28–33°C, indifferent temperature — 34–36°C, warm — 36–38°C, hot — 39–40°C — higher temperature is not recommended for children. Reduction in the temperature during the procedure should be taken into consideration. Duration of warm baths is 7–15 min, hot ones — 2–5 min. After water procedures the skin of the child should be dried rapidly and he should be dressed (to avoid overcooling). Water procedures can be administered from the first weeks of life.

In children with pneumonia, acute bronchitis warm moist mustard wrappings are used: 100 g of dry mustard are poured over with boiling water, dissolved in the basin (a bucket of water) — a diaper is wetted at the water temperature of 37–38°C, squeezed, the child is wrapped for 15–20 min with a dry sheet and blanket on the top. After the procedure the skin is dried and the patient is put to bed.

Hot moist wrappings with the help of the woolen cloth (45–50°C for 20–30 min) — it is mainly wrapping of the extremities or half of the body in children after 3 years old with the consequences of poliomyelitis and in children's cerebral paralysis.

Cold moist compresses or wrappings can be administered in hyperthermia and sunburns of the skin.

### Medicinal baths

1. Manganous baths (5% of solution of permanganate, 0.1 g of $KMnO_4$ per 10 l of water, 1 g per 100 l, pale pink): they are administered in pyodermas and fungal affection of the skin.

2. Mustard baths (50 g of dry mustard per 10 l of water): in pneumonia and bronchitis.

3. Coniferous baths (5 ml of the coniferous extract per 10 l of water): in rickets, rheumatism, and ulcer.

4. Starch baths (100 g per 10 l of water, 36–37°C): they are used as antipruritics, partially drying method.

5. Turpentine baths from the white emulsion (10–30 ml per 150 l, beginning with 10 ml, adding 2-3 ml for each subsequent bath). It is especially useful in diseases of the locomotor apparatus and peripheral nervous system.

### Mineral-gas baths (general and local)

1.Sodium chloride (10–20 g/l, 36–37°C). It is applied from the age of 5–6 month in rickets, polyarthritis, asthenia, neuroses.

2. Sea baths (10–20 g/l of salts, 36–38°C): in neuroses, consequences of different injuries, in diseases of the locomotor apparatus.

3. Iodide-bromine baths (mother waters of 100 g of sodium iodide, 250 g of potassium bromide per 1 l of water; 100 ml of mother waters added by 1–2 kg of common salt, 36–37°) are taken for the bath (150–200 l). They are recommended in diseases of the locomotor apparatus, neuroses, vegetovascular dystonia, and obesity.

4. Hydrogen sulfide baths (from 25 to 100 mg/l of $H_2S$): in vegetovascular diseases and dystonias, in diseases of the cardiovascular system, diseases and injuries of the locomotor apparatus.

5. Oxygen baths (oxygen contents — 35–45 mg/l): in neuroses, vegetovascular dystonias.

6. Pearl baths: they are indicated in the asthenic states, hypotensions, neuroses.

7. Carbonic baths (1–1.5 g/l of $CO_2$,): in the asthenic states, hypotensions, hyposthenic forms of neuroses.

The intake of the therapeutic mineral waters: therapeutic-table and therapeutic with salt concentration up to 5 g/l, mainly in diseases of the digestive organs.

### Thermotherapy (mud, paraffin, ozokerite, sand, salt, heating pad)

The temperature of the mud applications is 36-40°C, the temperature of ozokerite (ozozhilafin), paraffin is 45-48°C. Thermal procedures are mainly applied in diseases of the locomotor apparatus and nervous system, consequences of the tissue traumas, spasms of the smooth musculature.

### Electrotherapy

Different electroprocedures are administered to children at different age (see the table 5). The smaller the child, the more carefully the procedures are carried out: weak current, fields in the athermic or oligothermic regi-

mens, the procedure is 2–3 times shorter (in comparison with the adult), thorough controls for tolerance of the procedures, shortening of the course of treatment. Electric currents and fields are applied in children for electrical stimulation of the muscles and treatment of pain syndromes (pulse currents and magnetic fields), for the elimination of local inflammatory processes (electric field of UHF), for normalization of trophicity and improvement in the peripheral circulation, for influence on the traumatized tissues (inducto-, thermo-, UHF-inductothermy, microwave, low-frequency magnetotherapy), for treatment of neuroses and neurosis-like states (general franklinization, infita-therapy), diseases and injuries of the locomotor apparatus (microwave, inductothermy, low-frequency magnetic fields).

During electropathy of children the equipment of low output power is predominantly used. In particular, in administration of UHF therapy — apparatuses of UHF-5 (Minitherm), UHF-30, UHF-50 (Ustjie), for anesthesia — apparatuses of the TENS-therapy: Electronika-2, Delta-101 and-102, Neutron-1 and others, in administration of the microwaves: apparatuses Romashka, Ranet, Luch-4, -5.

### Phototherapy

It is expedient to use more frequently the visible rays in the pediatric practice (dark-blue light in hereditary and congenital hyperbilirubinemia), ultraviolet (rickets, pyoderma, general health strengthening and others) and laser (diseases of the organs of respiration and skin). UV-procedures are administered more frequently in the suberythemal and weakly-erythemal dosages.

*Ultrasound* is administered to children in the impulse regimen in diseases of the joints, fresh scars and burns, nonpurulent infiltrations (for their more rapid resolution). Ultraphonophoresis with medicinal substances may be used in a continuous regimen.

## 10.3. Medical Rehabilitation in Pediatrics

The aim of rehabilitation may be: the restoration of the anatomical structure of the damaged tissues and organs, restoration of the dysfunctions, development of the compensatory possibilities, normalization of psychoemotional disorders.

*The basic contingent of the sick children* who are subject to special attention during the rehabilitation after injuries, operations and diseases: children who suffer from cerebral paralysis, having had or having diseases of the respiratory tract, liver, poliomyelitis, tuberculosis, injury of the brain,

spine and spinal cord, damages of the extremities, those suffering from with diabetes mellitus.

Children who have had acute or chronic psychotrauma compose a special group.

*Principles of medical rehabilitation* in pediatrics: the use of modern achievements of the medical science and technology, systematic character, sequence and staging character of rehabilitation (hospital, sanatorium and dispensary-polyclinic stages), accountability of the influence of growth and development of organism on the dynamics of the pathologic processes, complexity of the methods (physio-, kinesi-, psycho-, diet, manual and pharmacotherapy, massage and others), combination of rehabilitation with teaching, the active participation of parents in rehabilitation, its completeness (reaching of the maximum result), use of the supporting therapy.

## 10.4. Physiotherapy of Separate Forms of Diseases in Children

### Nervous diseases

**Neuroses and neurosis-like conditions, forced motions, ticks (against the background of increased excitability of a child):**

— warm baths, conifer, salt-conifer, iodide-bromine (8–12 min, daily or in a day, N10–14);

— electric sleep at the low frequencies (5–10–15 Hz, current strength 0.1–0.2 mA, frontal-occipital position of the electrodes is 2–3 procedures, then eye-occipital, 30–40 min, in a day, N10–15, there may be oculo-mastoid position of the electrodes);

— collar electrophoresis with bromine, magnesium, calcium, seduxen, vitamin $B_1$;

— sparing, relaxing massage.

**Neurasthenia (hyposthenic form):**

— underwater douche massage (35–36°C, 10–15 min, daily or in a day, N5–8);

— weakly-thermal carbonic, pearl, oxygen, warm salt-coniferous baths (35.5–36°C, 10 min, in a day, N8–10);

— circular douche (36°C, 1–1.5 atm, up to 5 min, in a day, N8–10);

— tonic massage: general, of the spine, head and collar zone;

— sports games.

**Neurasthenia (hypersthenic form):**

— electrophoresis with sedatives based on the collar zone (bromine, seduxen and others by 10–15 min daily and in a day, N8–10);

— electric sleep (at frequencies of 20–40 Hz, 20–40 min, daily or in a day N6–8);

— soothing massage: general, of the spine;

— warm baths: sea, oxygen, iodide-bromine, hydrogen sulfide;

— general franklinization (5–15 min, in a day or twice a week, N6–8).

**Vegetovascular dystonia:**

a) by the *hypertensive* type:

— endonasal electrophoresis with a mixture of Ca-Mg (2% solution, 10 min, daily or in a day, N8–10);

— electrophoresis with Mg (2% solution $MgSO_4$, the currents of apparatus amplipulse on the collar zone, 10–15 min, in a day, N8–10);

— general franklinization (10–15 min, in a day, N7–8);

— electric sleep at the low frequencies (5–10–15 Hz, 30–40 min, in a day, N8–10);

— oxygen baths (36–37°C, 10–15 min daily or in a day N8–10);

— iodide-bromine baths (36–37°C, 10–15 min, daily or in a day, N8–10);

— sea bathings in the not cold water (the temperature is above 21–22°C);

— baths with the sea water (36–37°C, 10–15 min, daily or in a day, N8–10);

b) by the *hypotensive* type:

— electric sleep (20–40 Hz, 30–40 min, daily or in a day, N8–10);

— electrophoresis with Ca on the collar zone (8–15 min, daily or in a day, N8–10);

— massage of the spine and collar zone (energetic);

— carbonic or pearl baths (35–36°C, 5–10 min, daily or in a day, N8–10);

— circular douche with water of indifferent or cool temperature (35–36°C, 5–6 min, daily or in a day);

— sea bathings in the cool water (the temperature is higher than 18–20°C);

— cool douche and rubdown (28–32°C, 5–10 min, daily or in a day, N8–10);

— electrophoresis with 0.5% solution of Mezaton (phenylephrine hydrochloride) to the children of school age, employing the collar procedure (5–10 min, N6–8 in the presence of the physiotherapist).

To give the infita-therapy the apparatus Infita was used intended for the influence of impulse low frequency electromagnetic field (ILFEMF) in the frequency range of 10–80 Hz on the central nervous system without the direct contact with a patient. The patient was in the sitting position, at rest and was looking at the mirror screen of the emitter (the distance between the patient's face and the screen was 20–25 cm). The influence of ILFEMF was exerted through the visual organ in the highest regulatory centers of the brain. In sympathicotonia there were consecutively used frequencies from 10 to 60 Hz (the 1st and the 2nd day — 10–20–30 Hz with the exposure of 2 min on each frequency; the 3rd and 4th day — 30–40–52 Hz — by 3 min on each frequency; the 5th, 6th and 7th day — 52–57–60 Hz — by 4 min on each frequency, and beginning from the 8th day to the end of the course treatment — by 5 min on each frequency). In vagotonia there were consecutively used frequencies from 40 to 80 Hz (the 1st and 2nd day — 40–52–57 Hz by 2 min on each frequency; the 3rd and 4th day — 57–60–64 Hz — by 3 min on each frequency; the 5th, the 6th and the 7th day — 64–70–80 Hz — by 4 min on each frequency, and beginning from the 8th day to the end of the course treatment — by 5 min on each frequency). Procedures of ILFEMF were carried out in a day (in the days free from balneotherapy), with 10 procedures for the course.

**Indications to the application of ILFEMF**

1. Vegetative dysfunctions of permanent course in initial vagotonia, sympathicotonia or eutonia, beginning from the age of 3.
2. Vegetative dysfunctions in combination with neurosis-like syndromes.
3. Vegetative dysfunctions against the background of somatic pathology, which is accompanied by the weakly pronounced pain syndrome (diseases of the locomotor apparatus, gastrointestinal tract and others).
4. The most effective INFEMF is in the children of the younger age (7–11 years old) in reduction of protective-adaptive compensating mechanisms.

The advantages of INFEMF in children and adolescents with VD (vegetative dysfunction) are: good tolerance of the procedures by all patients; simplicity and convenience in carrying out the procedure (distance influence); universality and possible range width of the influence; the possibility of integration and association with other methods of rehabilitation treatment and application for prevention.

**Contraindications to the application of ILFEMF**

1. Age up to 3 years.
2. Paroxysmal course of the vegetative dysfunctions with frequent vegetative crises, pronounced orthostatic hypotension, syncope in anamnesis.

3. Vegetative dysfunctions in the period of exacerbation.

4. Vegetative dysfunctions against the background of the severe disturbance of the central nervous system of traumatic, infectious-allergic nature with the presence of the convulsive of syndrome in anamnesis.

5. Exacerbation and acute course of the chronic disease which requires adequate drug (or surgical) treatment.

6. Diseases of the eyes.

**Enuresis, in particular the night one:**

— mud pants (or mud trousers) — (38–40°C, 10–15 min, in a day, N8–10);

— electrophoresis with 0.1% solution of proserin on the projection of the bladder (10–15 min, in a day, N8–10);

— electrophoresis with 0.1% solution of atropine (on the anode — sacrum, on the cathode — above the pubes, 12–20 min, daily or in a day, N10–15);

— electrical stimulation of the bladder by diadynamic currents (rhythm of syncope, single-cycle wave for 3–5 min, daily, N10–12), SMCs (nonrectified regimen, II kind of work, depth of modulations 50–75–100%, frequency — 10–30 Hz, 6–8 min, N10–12);

— electric sleep in the increased excitability of the nervous system (10–40 Hz, 20–30–40 min, in a day);

— endonasal electrophoresis with Pavlov's mixture (5–8–10–12 min, in a day, N10–12);

— the local d'arsonvalization of the perineum and thighs, lumbar-sacral region (3–6 min, daily, N10–12);

— massage of the spine (N8–10);

— UV-irradiation of the lumbar-sacral zones, thighs, buttocks (1–2 biodoses, in a day, N2–4);

— warming of the feet, especially at the night time.

**Consequences of the brain injuries and encephalitis**

1. In the acute period:

— rest, cold to the head, including controlled hypothermia;

— magnetotherapy.

2. In the period of rehabilitation (arachnoiditis, cerebral hypertension, liquor syndrome and others):

— electric field of UHF bitemporally and biauricularly in the athermanous dosages (5–10 min, daily, N6–8);

— transcerebral electrophoresis with iodine, novocaine, hyaluronidase (5–10–15 min, daily, N10);

— magnesium electrophoresis on the collar zone (10–15 min, daily or in a day, N8–10);

— hydrogen sulfide baths ($H_2S$ — 0.03–0.1 g/l, 36–37°C, 5–8 min, daily, N8–10);

— pearl baths (36–37°C, 5–10 min, daily or in a day, N8–10);

— oxygen baths (35–45 mg/l, 36–37°C, 10–15 min, daily or in a day, N10–15);

— carbonic baths (35–36°C, 5–10 min, N8–10);

— mud applications to the collar zone (37–38°C, 5–10 min, in a day, N8–10);

— paraffin-ozokerite applications (45–47°C, 10–12 min, daily or in a day, N10–12);

— massage of the collar zone;

— UV irradiations (1–2 biodoses paravertebrally or to the collar zone, in a day, 3–5 times of one field).

**Humeral ancestral plexitis (Erb's spinal paralysis):**

— heat to the region of the brachial plexus (Minin's lamp or sunlamp, 5–10 min, 2–3 times a day, N8–10);

— paraffin-ozokerite applications to the region of the brachial plexus (45–48°C, 15–20 min, daily, N12–15);

— electrical stimulation of the paralyzed muscles (5–10 min, daily, N15–20);

— electrophoresis with novocaine (0.5–1%), proserin (0.05%) to the region of the upper extremity (longitudinally for 10–20 min, N10–15);

— mud applications (38–39°C, 10–15 min, in a day, N10);

— hydrokinesitherapy in the ponds or baths;

— massage and exercise therapy.

**Small chorea:**

— electric field of UHF longitudinally to the forehead — back of the head (athermanous dosage, 7–10 min, in a day, N10–12);

— electrophoresis with sodium bromide (2–3%), transcerebral (1% solution of NaBr, 10–15 min, daily);

— electric sleep (5–10 Hz, 15–20 min, daily, N10–15);

— general coniferous or hydrogen sulfide baths (50–75 mg/l $H_2S$, 37–38°C, 5–10 min, in a day, N8–10);

— general UVI according to the accelerated scheme.

**Myopathies:**

— electrical stimulation of the affected muscles (apparatuses of diadynamic currents, Amplipulse, Stimule for 5–10 min, 10–20 procedures for the course);

— ultrasonic irradiation of the affected muscles (0.1 –0.4 Wt/cm$^2$, 3–5 min to one muscular group, not more than 10–12 min, daily or in a day, N10–15);

— local d'arsonvalization of the affected muscles (3–5 min to one muscular group, no more than 15 min, daily or in a day, N10–15);

— general carbonic, pearl baths (36–37°C, 5–10 min, daily or in a day, N10–12);

— massage, exercise therapy.

**Polyomyelitis after the temperature abatement (acute period):**

— light baths for the extremity (10–15 min, daily, N10–15);

— electric field of UHF to the affected region of the spinal cord (athermic or oligothermic dosage, 5–10 min, daily, for 4–5 days);

— microwave actions (DMW or CMW, apparatuses of the type Romashka or Ranet, Luch-4.5) to the affected zone of the spinal cord (regimen is oligothermic, 5–10 min, daily, for 4–5 days);

— UHF-inductotherapy to the affected zone of the spinal cord (regimen is oligothermic, 5–10 min, daily, N4–5);

— general warm baths, including salt (10–20 g/l, 10–15 min, daily, N4–5)

**Polyomyelitis (rehabilitation period):**

— electrical stimulation of the paretic muscles (for 5–10 min, daily, N15–20);

— massage and exercise therapy (hydrokinesitherapy in the ponds or baths);

— mud applications to the spine and the affected muscles (38–40°C, 15 min, in a day, N10);

— paraffin-ozokerite applications (45–47°C, 15–30 min, daily or in a day, N10–20);

— baths — coniferous, carbonic (36–37°C, 10 min, daily or in a day, N10–15);

— air baths, nondosed or dosed according to the tables;

— heliotherapy, dosed according to the tables;

— UV irradiations — general, according to the delayed scheme.

**Children's cerebral paralysis:**

— diadynamo- and amplipulse therapy to the weakened muscles in the regimens of electrical stimulation, 10–15 procedures;

— electric sleep (10–30 Hz, 30–40 min, daily and in a day, N10–15);

— electrophoresis with potassium iodide (1–2%, 10–15 min, daily or in a day, N10–15);

— electrophoresis with magnesium sulfate (2–3%) or novocaine (0.5–1%) to the collar zone (5–10 min, daily or in a day, N10–12);

— mud applications to the collar zone (36–38°C, 10–20 min, in a day N10);

— paraffin-ozokerite applications to the collar zone (45–48°C, 10–15 min, in a day, N10–15);

— general baths: oxygen, nitric, hydrosulfuric, coniferous;

— massage and exercise therapy.

**Anorexia:**

— UVI according to the general or delayed scheme;

— electrophoresis with calcium chloride (1–2%) to the collar zone (5–15 min, daily, N12–15);

— electrophoresis with sodium bromide (2–3%) general by Vermel (5–15 min, in a day, N10–15);

— general oxygen, nitric baths (36–37°C, daily or in a day, N8–10);

— aerotherapy undosed or dosed according to the tables;

— drinking of carbonate therapeutic waters 20–30 min prior to meal 3 times a day for 2–3 weeks.

## Diseases of the Respiratory Organs and Tonsils

**Acute catarrhal-infectious diseases (ACID) (procedures should be carried out in the warm premises, in the ward):**

— UV irradiation of the face, collar zone, chest — weak doses (1–2 biodoses, in a day, N3–4);

— UV irradiation of the soles (moderate erythemal, strong erythemal doses, beginning with 3–8 biodoses (age), in a day or in 2 days on the 3rd one, 3–5 procedures);

— endonasal UV irradiations (tube-quartz, 0.5–1.5 min on each side, in a day, N3–4);

— medicinal inhalations (broncholytic and antipyretic mixtures: the infusion of sage, the juice of plantain, kalankhoe, sulfacetamide, alkaline, salt–alkaline waters);

— abundant drinking of hot water;

— hot general baths (39–40°C, 10–15 min, daily, N3–4).

**Exacerbations of chronic tonsillitis and angina:**

— UV irradiation of the tonsils (tubus-quartz 1–2 min for the procedure, daily, N5–6);

— electric field of UHF to the projection of the tonsils (6–8 min, daily, N5–6);

— UV irradiation in weak and moderate erythemal doses (1–3 biodoses) of the collar zone by two fields (from the front and from behind) each field in a day, 4–5 irradiations of one field for the course;

— in absence of purulent plugs ultraphonophoresis with hydrocortisone (ocular ointment) or interferon (in elder children — to the tonsils, in young — outside, on their projection), continuous regimen (0.2–0.4 Wt/cm$^2$, daily, 4–8 min, N5–6).

**Chronic tonsillitis:**

— ultraphonophoresis with interferon or hydrocortisone (5–10 min, in a day, N8–12);

— laser irradiation of the tonsils (0.15–0.3 mWt/cm$^2$, 2–3 min for one tonsil, N10–15);

— UV irradiation of the tonsils and collar zone (1–3 biodoses, in a day, 6–8 procedures for the course);

— microwave influence on the projection of the tonsils of the apparatuses Luch-3, 4, 5, Romashka and Ranet (5–7 min on each side, oligothermic and moderate thermal doses, daily, N10–12);

— in absence of purulent plugs to rinse the oral cavity and nasopharynx with the infusion of sage, camomile, sea water.

**Chronic rhinosinusitis:**

— centimeter waves (apparatuses Luch-4, -5) to the additional cavities (oligothermic dosage, 10–12 min daily, N8–10);

— UHF inductothermy to the paranasal sinuses (5–10 min, daily, N8–10);

— UV irradiation of the nasal mucosa in the weakly-erythemal dosages (1–2 biodoses, daily, N4–5, cannot be given in atrophic rhinitis);

— laser irradiations of the nasal mucosa;

— UV irradiation of the face and collar zone (1–3 biodoses, 1–2 fields a day, influence of one field once in 2–3 days);

— foot hot baths with mustard (for 10–15 min, daily, N8–10);

— paraffin and ozokerite applications to the forehead, nose and projection of the accessory sinuses of the nose (45–46°C, 10–15 min, daily or in a day N8–10);

— mud applications to the face and collar zone (37–38°C), mud socks (40–42°C, 10–15 min, in a day, N8–10).

**Allergic rhinitis:**

— endonasal electrophoresis with intal (1 capsule in 3 ml of the distilled water), calcium chloride (2%), dimedrol (1%), mud squeezing (10–15 min, daily, N10–12);

— local d'arsonvalization (electrode in the region of the beginning of the nasal passage, 2–5 min, daily, N5–10);

— low-frequency magnetotherapy (5–15 min, daily or in a day, N8–10);

— aeroionotherapy (10 15 min, daily, N15 — 20);

— phonophoresis with hydrocortisone, splenin (3–10 min, daily, N8–10);

— red laser therapy endonasally (2–4 min, daily, N8–10).

**Bronchial asthma**

1. In the period of exacerbation:

— inhalation of the broncholytics: salbutamol (ventolin, albuterol) — 0.5%, 0.1–0.16%, 0.05%–0.08%, phenoterol (0.1%), atropine (0.1% 0.25–0.5 ml in 2–5 ml of the distilled water), ipratropium bromide (0.025%), berodual (0.05% of phenoterol and 0.025% of atrovent), metacin (0.1% 0.25–0.5 ml in 2–5 ml of the distilled water), euphyllin (aminophylline) (2.4% 1 of 5 ml), ephedrine (2% 1 ml in 2 ml of the distilled water);

— laser-puncture, 10–14 biological active points are irradiated for one session, the time of the influence on one point is 40–60 sec, the general exposure is 10–15 min, the density of power flow at the output of light guide is 5th 15 mWt/cm, N8–10;

— laser therapy by the defocused ray paravertebrally at the level of the upper thoracic vertebrae (single irradiation dose is 30–40 J, total 360–400 J, N8–10);

— DMW therapy to the adrenal glands (10 min, N10–12).

2. In the stage of rehabilitation treatment:

— treatment under the conditions of the artificial microclimate of salt aerosol (concentration is 12–18 mg/m$^3$, particles of up to 3 mcm in size up to 70–80%, the temperature is 21–24°C), the duration of the session: 3–5 years old — 10–20–30 min, 6–11 years old — 15–30–45 min, over 11 years old — 20–40–60 min, once a day, N22–25 or 5–6 times a week;

— normal-baric hypoxitherapy (oxygen contents in the gas mixture is 10–14%, 3–4 hypoxic phases for 10–15 min with the same interruptions for a session, in a day N10–12 or 4–5 procedures a week);

— aerosol therapy: aqueous solution mummiye (0.2–0.3 g of mummiye), peloidin (10–20 ml);

— aeroionotherapy (10–20 min, daily or in a day, N15–20);

— ultrasound in the continuous regimen by a labile procedure, three zones on either side of the chest: paravertebral (for 3 min), intercostal (for 2 min) and subclavicular (for 30 sec), the first day — the first zone, the second — the 1st and 2nd zone, then — all three zones, once a day, for 8–10 days, then in a day, N12–15;

— phonophoresis with hydrocortisone (suspension of hydrocortisone 5.0 ml, vaseline and lanoline up to 25.0 g);

— interference-therapy to the region of the spleen, by the trophic procedure, 10 min, N9–10, or 5–6 times a week;

— laser therapy to the region of the spleen (arsenide-gallium laser), frequency of 80 Hz, exposure is 128 on the point, two points — across the medioclavicular line in the 11th intercostal space and across the medium armpit line in the 8th intercostal space by the contact procedure with the position of the emitter perpendicularly to the body surface, daily or in a day, N9–10;

— SMC-therapy, paravertebrally to the interscapular region (alternative regimen, I and III type of work, frequency — 100 Hz, the depth of modulation is 50%, the pulse (2–3 sec), for 3–5 min by each type of work, once a day, N8–10);

— electrophoresis with calcium chloride (1–5%), to the region of the chest (daily or in a day, N10–12);

— general carbonic baths (33–36°C, 10–15 min, in a day, N10–12);

— low-frequency magnetotherapy (10–15 min, daily or in a day, N10–15).

**Pneumonia**

1. In the stage of infiltration (first 1–3 days of the disease):

— electric field of UHF, to the projection of the pneumonic focus (10–15 min, N10–15, 4–6 procedures a week);

— inhalation of antiseptics: furacin (0,02%), chlorine-phyllipt (0.1% alcohol solution), novoimanin (0.1% alcohol solution);

— intratissue medicinal electrophoresis (in intravenous dropwise introduction of antibiotic after introduction of 2/3 volume, in flow or intramuscularly in one hour after introduction, in inhalation — immediately after inhalation), the position of the pneumonic focus in the interelectrode space (20–30 min, daily or in a day, N10–12);

2. In the period of resolution:

— inhalation of mucolytics: sodium bicarbonate (1–2%), Ringer's solution, iodide potassium (0.1% and 1%), bicarbonate mineral waters (25–50 ml), acetylcysteine (3–5 ml 10% or 20% solution), mucosolvin (mucomix) — 20%, mistabon (20%), brominehexyne (bisolvon, flegamin) — 0.2%, ambroxol (lasolvan, mucosolvan) — 7.5%, N10–15;

— electrophoresis: sodium chloride 1–5% (iodide potassium — 1%) to the region of the chest, daily, N10–12, trypsin (chymotrypsin) 10 mg in 15–20 ml of the distilled water to the lateral side of the chest, active electrode — cathode, 10–15 min, daily, N10–12, heparin (5–10 thousand in 30 ml of the distilled water, active electrode — cathode, to the posterior — lateral surface of the chest (10–15 min, daily or in a day, N8–10);

— magnetolaser therapy, on three points across the medium-clavicular, medium-axillar and midscapular lines to the region of the inflammatory infiltration, and then to the region the thymus projection in the upper third of the breastbone (pulse repetition rate is 37–50 Hz, exposure — 60 sec on each point, daily, N7–8);

3. In the period of residual phenomena:

— electrophoresis with copper sulfate 0.5–2% (calcium chloride 1–5%), active electrode — anode to the lateral surface of the chest (10–15 min, daily or in a day, N10–12);

— inductothermy, consecutively two fields (the first one against the level of Th4, Th8, the second one — Th9–L1) from the back, weakly-thermal dosage (8–10 min for one field, daily or in a day, N10–15);

— ultrasonic therapy (to three pairs of currents: the first — paravertebrally on each side of Th1–Th12 for 3 min, the second — in the region of VI–VII and VII–VIII intercostal spaces on each side from the paravertebral to the medium–axillary line for 2 min, the third — subclavicular zones for 30–40 sec), the procedure is labile, regimen is continuous or pulse (10 ms), the first procedure is carried out only to the first zone, the second — to the 1st and 2nd, from the third day — to all zones, daily, N12–15;

— heat-treatment employing the cuvette — application procedure (ozokerite 40–42°C, paraffin 43–35°C, 15–20 min, daily, N8–10).

**Acute bronchitis:**

— inhalation of antiseptics: furacin (0.02%), chlorine-phyllipt (0.1% alcohol solution), novoimanin (0.1% alcohol solution), hydrogen peroxide (1–3%), garlic juice (1 ml with 3 ml of 0.5% novocaine), onion juice (1 ml with 3 ml of the distilled water);

— inhalation of mucolytics;

— magnetotherapy, regimen is continuous, daily or in a day, N10–12;

— DMW-therapy, consecutively two fields from the back (the first at the level of Th 4–Th8, the second — Th9–L1), for 8–10 min to each field, N8–10, 4–6 procedures a week (it is possible to influence only the interscapular region);

— CMW-therapy of the interscapular region (4–12 mWt), 6–10 min, daily, N6–8.

***In presence of bronchial obstruction:***

— inhalation of broncholytics;

— SMC-therapy, paravertebrally in the interscapular region (type of work III and IV, for 5 min on each, depth of the modulations is 50%, pulse frequency is 70–80 Hz, duration of ahalf-period is 3:3 sec, in a day, N10–12);

***In the prolonged course:***

— UVI of the chest, two fields a day: the first — front surface of the neck and upper half of the breastbone (3 biodoses), the second — posterior surface of the neck and upper half of the interscapular region — 9–4 biodoses). The total area of irradiation is no more than 600 cm, 2–5–6 procedures, in 1–2 days;

— the methods of heat, mud or US therapy.

**Recurrent bronchitis**

In exacerbation the treatment is the same as in acute bronchitis and in the period of remission:

— treatment under the conditions of the artificial medium of salt aerosol;

— UVI of the chest, irradiation of 5 fields: the first and the second — half of the posterior surface of the chest (right or left, upper or lower), the third and the fourth — lateral sides of the chest, the fifth — the front surface of the chest to the right, one field is irradiated per day, 3–4 biodoses, each field is irradiated 2–3 times during the course, daily;

— mud applications to the interscapular region (it is possible additionally in the form of semibelt at the level of Th8–11, 38–39°C, 10–15 min, daily, N8–10);

— electrophoresis with mud solution (gumizol, peloidin, pelovit) to the lateral surfaces of the chest (10–15 min, daily or in a day, N8–10);

— the methods of thermotherapy or US-therapy;

— inductothermy of the region of the adrenal glands (weakly warm dose, 15 min, daily or two days in a row with the subsequent interruption, N10–15);

— sodium chloride baths.

## Diseases of the Digestive Organs

**Chronic gastroenteritis (gastroduodenitis):**

— light heat to the stomach area (sunlamp for 10–15 min, daily, N10–12);

— electrophoresis with calcium (2–3%) to the region of the stomach projection (anode in the epigastric zone, cathode — in the lower part of the back;

— electrophoresis with bromine employing the collar procedure (10–15 min, in a day, N6–8);

— electric sleep (10–15 Hz, 30–50 min, daily or in a day, N12–20);

— DMW to the region of the stomach in pains, especially during the normal and hyposecretion. It is possible in increased one, but in clear oligothermic component (apparatuses Romashka, Ranet, output power is 8–12 Wt, for 8–10 min, daily or in a day);

— CMW-therapy to the region of the stomach (Luch-4.5, 4–5 Wt, 8–10 min, in a day, N8–10);

— inductothermy (IKV-4) to the region of the stomach (oligothermic dosages, 10–15 min, N8–10);

— galvanization of the stomach (with hypersecretion the anode is in the epigastric zone, with hyposecretion — the cathode, 0.04–0.05 mA/cm$^2$, 10–15 min, N10–12);

— electrophoresis with novocaine (2–4%) in pains;

— UV irradiation of the stomach in hyposecretory gastritis (1–1.5–2–3 biodoses, only 5–8 irradiations);

— application of ozokerite and paraffin to the region of the stomach (45–46°C, 15–20 min, in a day, 8–10 procedures);

— therapeutic mud to the region of the abdomen (38–40°C, 15–20 min, in a day, N6–8);

— therapeutic mineral waters of low concentration (alkaline — in hypersecretion, acid — in hyposecretion, 100–150 ml, 2–3 times a day, in severe heartburns — 30–40 min after meal, in hypersecretory function — 35–40%, 1–1.5 hrs prior to meal, in hyposecretory function — 20–30°C, 20–30 min prior to meal.

**Chronic diseases of the liver and cholecystitis:**

— bicarbonate-sulfate, sulfate-chloride, bicarbonate mineral waters of the low and medium mineralization (Slavyanovska, Kuyalnik, Mirgorodska, Luzhanska and others), warm, to sip slowly, 30–60 min before meal , 3 times a day (5 ml/kg);

— inductothermy (in small children — UHF-inductothermy) (10–15 min, daily, N8–12);

— electric field of UHF to the region of the liver from the front, to Th7–Th10 from behind (clearance is 3 cm, up to the sensation of heat, 40 Wt, 10 min, in a day, N10);

— DMW (oblong emitter with the clearance of 5 cm above the region of the liver, up to the sensation of heat, 10–15 min, N10);

— SMC-phoresis 3–5% solution of magnesium sulfate (rectified current, III type of work, the depth of modulations is 50–75%, frequency — 70–100 Hz, 5 min, the first 4–5 procedures in a day, the rest — daily, N8–10, the anode is 200 cm$^2$ above the projection of the gall bladder, the cathode — Th7–Th10);

— AMF in the position on the left side (cylindrical inductors, transversely, the regimen is continuous, 15–20 min, in a day, N10);

— US paravertebrally Th7–Th10, (pulse regimen 4–10 ms, frequency — 880 kHz, power — 0.2 Wt/cm$^2$, 2–3 min, in a day, N10);

— US of the liver region (0.2–0.4 Wt/cm$^2$, pulse — 4–10 ms, 5 min, in a day, N10);

— paraffin applications (45–46°C to the region of the liver, 15–20 min, daily or in a day, N10);

— ozokerite applications (45–46°C to the region of the liver, 15–20 min, daily or in a day, N10);

— hot water bottle (47–48°C, 20 min, twice a day, N5);

— mud therapy (39–40°C, mud cake with the area of 100–200 cm$^2$, thickness — 2–3 cm, 15–20 min, N10);

— electromud therapy — galvanomud (the anode is above the region of the liver, the cathode — to the right of the spinal column, 36–38°C, the current density is 0.05 mA/cm$^2$, 20 min, in a day, N10);

— sea, coniferous, iodide-bromine, oxygen, radon baths (36–38°C, concentration is 1.5 kBq/l, 10–12 min, carbonic concentration is 0.8–1.0 g/l, 35–37°C, 10–15 min, daily or in a day, N10);

— laser therapy, scanner (dose is 0.09 J/cm$^2$, the area of irradiation is 4×5 cm or to biologically active points, N10).

**Functional disturbances of biliary excretion**

*Hypotonic type:*

— bicarbonate-sulfate, sulfate-chloride, bicarbonate mineral waters of high mineralization (Essentuki 17, Arzni and others), warm, to sip slowly 60–90 min before meal, 3 times a day (5 ml/kg);

— electrophoresis with 2–3% magnesium sulfate, 0.2% solution of plathyphyllin or 2% solution of papaverine to the right subcostal area (the current density is 0.02–0.05 mA/cm$^2$, 15–20 min, daily, N10–12);

— SMC (I–III type of works, frequency is 70–100 Hz, the depth of modulations — 70–100%, the duration of the dispatching pause — 2–3 min, to the right subcostal area, current strength up to the sensation of weak vibration, 10–15 min, daily, N10);

— DDC — the area of the electrodes is 200 cm$^2$, the cathode is above the region the gall bladder projection, the anode — on the spine from behind Th7–Th10 (SP, LP, LW by 3 min, daily, N12);

— SMC- and DDC-mud cure, cakes of 2–3 cm thick, the temperature is 28°C, the electrode area is 200 cm$^2$ placed above the region of the right subcostal area (SMC, II–III type of work for 5 min, the regimen is rectified, the depth of modulations — 50%, frequency — 75 Hz, the duration of the

dispatching pause — 1–1.5 sec; DDC — LW and OW by 5 min, the cathode is on the gall bladder projection, current strength is up to the sensation of vibration, daily, N10–12;

— Charcot douche (34–20°C, 5 min, daily, N10);

— circular douche (34–25°C, 5 min, daily, N10);

— sea, coniferous, iodine–bromine, oxygen, radon baths (36–38°C, 1.5 kBq/l, 10–12 min), carbonate (0.8–1.0 g/l, 35–37°C, 10–15 min, daily or in a day, N10);

— SMF therapy to biologically active points (wavelength is 4.9 mm, the regimen is continuous, 5 min to the point, daily, N10).

*Hypertonic type:*

— bicarbonate-sulfate, sulfate-chloride, bicarbonate mineral waters of low and medium mineralization (Slavyanovska, Kuyalnik, Mirgorodska, Luzhanska, Essentuki-4, Narzan and others), warm, to sip slowly, 30–60 min before meal, 3 times a day (5 ml/kg);

— electrophoresis with 0.25% novocaine, 0.1% atropine sulfate, 0.2% solution of plathyphyllin or 2% solution of papaverine to the right subcostal area (the current density is 0.02–0.04 mA/cm$^2$, 15–20 min, daily, N10–12);

— paraffin applications (45–46°C to the region of the liver, 15–20 min, daily or in a day, N10);

— ozokerite applications (45–46°C to the region of the liver, 15–20 min, daily or in a day, N10);

— hot-water bottle (47–48°C 20 min, 2 times a day, N5);

— mud therapy (39–40°C, mud application with the area of 100–200 cm$^2$, thickness — 2–3 cm, 15–20 min, N10);

— electromud therapy — galvanomud, the anode is above the region of the liver, the cathode is to the right of the spinal column (36–38°C, the current density is 0.03–0.05 mA/cm$^2$, 15–20 min, in a day, N10);

— sea, coniferous, iodide-bromine, oxygen (concentration is 40–45 mg/l), radon baths (36–38°C, concentration is 1.5 kBq/l, 10–12 min, in a day, N10, carbonic concentration is 0.8–1.0 g/l, 35–37°C, 10–15 min, daily or in a day, N10);

— inductothermy (in small children — UHF-inductothermy), 10–15 min, daily, N8–12;

— electric field of UHF to the region of the liver from the front, Th7–Th10 from behind, (clearance is 3 cm, up to the sensation of heat, 40 W, 10 min, in a day, N10);

— DMW (oblong emitter with the clearance of 5 cm) above the region of the liver, up to the sensation of heat (10–15 min, in a day, N10).

## Diseases of the Locomotor Apparatus

### Chronic osteomyelitis

— electric field of UHF to the projection of the focus, the electrodes are placed transversely (oligothermic regimen, 8–10–12 min, daily, up to 30–40 procedures);

— electrophoresis with calcium, potassium iodide, trypsin, hyaluronidase (10–15 min, daily, N10–15);

— general and local UV irradiation in weak and medium erythemal dosages;

— sodium chloride, sea, iodide-bromine, sage baths (37–38°C, 10–15 min, daily or in a day, N10–15);

— hydrogen sulfide baths (5–10 min, in a day, N10–12).

— mud applications above the affected extremity (37–38°C with gradual elevation to 40–41°C, 15–20 min, in a day, from 8 to 16 procedures for the course. The fistula should be covered by 3 layers of gauze);

— after operations, in slightly increased ESR, in the periosteal applications the electrophoresis with therapeutic mud is more preferable to the region of affection of the bone (12–15 min, 38–40°C, 12–14 procedures, transverse or longitudinal procedure);

— dosed solar baths in the morning hours;

— sea or salt–water bathings (temperature is higher than 20–21°C);

— intravenous laser irradiation of blood (ILIB) and UV irradiations of the blood (in the elder group of children).

### Rheumatism (articular form)

*Prevention and treatment*

In acute attack (up to 2–3 months) physical factors are not used (in–patient department).

— in subsiding of the acute phenomena (I–II stage of activity) UV irradiation of the affected joints (1–2 biodoses for two large joints a day or a group of small ones, 3–5 procedures of one localization for the course).

In the inactive phase not only joints but also general or paravertebral segmental irradiations are irradiated (from 1 to 2–3 biodoses, 10 irradiations for the course). It is better to use DUF.

— in the sluggish course of rheumatism it is possible to apply the UV irradiation of the blood;

— general electrophoresis ($CACl_2$ 2–3% or salicylic acid, 10–15 min, daily, N10–12);

— hydrogen sulfide baths (25–100 mg/l $H_2S$, 37–38°C, 5–10 min, daily, N8–10);

— iodide-bromine baths (37–38°C, 10–15 min, daily, N10–15);

— in arthralgia light heat to the joints or the electrophoresis with novocaine;

— sanitation of the tonsils (including UV irradiations, electric field of UHF, ultrasound, washing with mineral waters);

— sodium chloride and sea baths (10–20 g/l, 37–38°C, 10–15 min, N10–15);

— carbonate, oxygen, pearl baths (10–15 min, daily or in a day, N10–12);

— radon baths (1.5 kBq/l, 36–37°C, 10–15 min, daily or in a day, N10–12);

— mud applications (39–40°C, 10–15 min, in a day, N8–10);

— diluted mud baths (36–37°C, 10–15 min, in a day, N8–10);

— mud compresses (39–40°C, 60 min, in a day, N10–15);

— ozokerite, paraffin, sand;

— climatotherapy;

— exercise therapy and massage.

**Rheumatoid polyarthritis (prevention and treatment):**

— sanitation of the foci of chronic infection;

— in the acute period — the complex of treatment includes the UV irradiation of the joints (2–5 biodoses, once in 2–3 days, 3–4 procedures for the course).

Physiotherapy in the moderate or low activity of the process, the chronic course, remission:

— electric field of UHF to the region of the joint (the clearance is 2–3 cm, oligothermic dosages, 7–10 min, daily or in a day, up to 10 procedures, transverse or longitudinal procedure);

— microwaves to the joints (5–10 min, daily or in a day, N8–10);

— ultrasound to the joints (0.1–0.2 Wt/cm$^2$, pulse regimen, for 2–5 min, in a day, N8–10;

— phonophoresis with hydrocortisone to the joints (0.2 Wt/cm$^2$, continuous regimen, paravertebrally in the pulse regimen, 5–10 min, daily, N10–15);

— diadynamotherapy in the anaesthetizing regimens, diadynamophoresis with novocaine (10–15 min, daily, N10–12);

— stimulation of the function of the adrenal glands: UV rays, electric field of UHF, inductothermy, microwaves;

— mud therapy: application, diluted baths, compresses, phono- and electrophoresis with therapeutic mud and its preparations;

— paraffin and ozokerite (46–48°C, 20–30 min, daily or in a day, N10–15);

— electrophoresis with calcium, iodide, salicylates, hyaluronidase;

— general electrophoresis with calcium and salicylates by Vermel (15–20 min, daily or in a day, N10–12);

— sodium chloride, radon, hydrogen sulfide baths (36–37°C, 8–10 min, daily or in a day, N10);

— laser irradiations of the joints and blood;

— exercise therapy and massage;

— climatotherapy.

**Osteochondropathies (treatment in the rehabilitation period):**

— relief of the extremity;

— massage and exercise therapy (I–II stage);

— physiotherapy as early as possible: electric field of UHF, DMW and CMW, inductotherapy, electrophoresis with iodide, calcium, trypsin, general UV irradiations, physiopuncture, magnetotherapy;

— balneotherapy (better from III st.): sodium chloride, sea, iodide-bromine, carbonic, hydrogen carbonic sulfide baths (36–37°C, 8–10 min, daily or in a day, N10–12);

— mud therapy: mud applications, more frequently pants (38–40°C, 10–12 min, N10–12), mud socks; mud diluting baths.

**Scoliosis of the spine (prevention and treatment):**

— relief of the spine;

— general strengthening therapy: multivitamins, chondroprotectors, rational nourishment;

— orthopedic methods: corset, special positions;

— exercise therapy and massage (hydrokinesitherapy);

— mild traction of the spine by one's own weight, after the age of 10, during massage and electrical stimulation of the muscles, which oppose to scoliosis;

— electrical stimulation of the muscles, which oppose to bending (5–10 min, daily N10–15);

— balneotherapy: sodium chloride baths (20–40 g/l, 37–38°C, in a day, 10–15 min), hydrogen sulfide baths ($H_2S$ 50–100 mg/l, 36–37°C, 10–15 min), turpentine baths according to the scheme, swimming in the pool, underwater douche — massage up to 1.5 atm;

— mud applications to the spine (38–39°C, 15–20 min, in a day, N8–10);

— sea bathings, bathing in the estuary (at the water temperature not lower than 22°C);

— UV irradiation (general or paravertebrally according to the schemes);

— electrophoresis with calcium along the spine (2–3% solution, 10–15 min, daily or in a day, N10–12);

— inductothermy by the cable, placed above the spine (oligothermic dosages, 10–12 min, in a day, N6–8);

— microwave influence on the spine (oligothermic dosage, 10–12 min, in a day, N6–8);

— manual therapy.

Courses of treatment should be given once 3 months if possible.

**Dermatomyositis:**

— salt-water baths at the stage of remission as well as in the minimum and moderate activity of the inflammatory process (36–37°C, daily or in a day, N10–15);

— carbonic-brine baths ($CO_2$ 1–1.2 g/l), in a day, 36–37°C, 5–7–10 min, N6) in involvement of the heart muscle in the process;

— mud therapy (mud compresses to the affected sections, 39–40–42°C, 15–30–60 min, in a day, N12);

— electrophoresis with therapeutic mud to the region of the adrenal gland projection (0.03–0.05 mA/cm$^2$, 39–40°C, 10–12–15 min, in a day, N10);

— electrophoresis with hyaluronidase to the region of the affected sections (children aged 3–6 — 16–32 U, 7–10 — 32–64 U, older than 10 years — 64 U, 12–15 min, daily, N12–15);

— massage and exercise therapy;

— electric sleep (10–15 Hz, 20–40 min, daily or in a day, N12–15);

— ultrasound (0.05–0,2 Wt/cm$^2$, children aged 6–8 — for 1 min, elder — 1–2 min, in a day, N10);

— inductothermy by disk inductor, local — weakly-thermal dosages, 10–12 min, daily;

— UVI for sanitation of the foci of chronic infection — from 1 to 5 min, N10–15.

## Other Diseases of Children

**Scleroderma:**

— salt-water or carbonic salt-water baths ($CO_2$ 1–1.2 g/l, 36–37°C, 5–7–10 min, N4–5);

— mud applications to the sclerodermic foci (39–40°C, 10–30 min beginning from 10 to 30 min, in a day, N20–24);

— electrophoresis with hyaluronidase to the region of the affected areas (3–6 years old — 16–30 U, 7–10–32 — 64 U, older than 10 years — 64 U, 10–15 min, N10–12);

— massage of the affected areas with rubbing in the sea-buckthorn oil;

— application of paraffin and ozokerite to the struck sections (45–46°C, 15–20 min, in a day, N8–10);

— inductothermy by disk-inductor (weakly-thermal dosages, 10–12 min, daily, N10–12);

— ultrasound (0.2–0.4 Wt/cm$^2$, 5–10 min, daily or in a day, N8–10).

**Congenital defects of the heart:**

— exercise therapy in the special group with slight exertion, sparing regimen;

— oxygen baths (30–40 mg/l, 35–36°C, 10–15 min, in a day, N10–15);

— carbonic baths (1–1.4 g/l, 36–37°C, 10–15 min, N10–15);

— sulfide baths by the sparing regimen (25–10 mg/l $N_2S$, 37°C, 10–15 min, in a day, N10–15);

— drinking treatment with slightly mineralized waters (3–5 ml/kg of weight, 100–150 ml, 2–3 times every day before meal, 3–4 weeks);

— electric sleep (10–15 Hz, 30–40 min, in a day, N12–15).

**Functional cardiopathies**

— UV irradiation of the tonsils (tube quartz, 1 min, daily or in a day, N8–10);

— electrophoresis with calcium chloride or sodium bromide (2–3%) employing the collar or general procedures (10–15 min, daily or in a day, N8–10);

— electric sleep (10–15–20 Hz, 30–40 min, in a day, N8–10);

— circular douche (37°C, 3–5 min, daily or in a day, N8–10);

— carbonic, iodide-bromine or sodium chloride baths (36–37°C, 10–15 min, daily or in a day, N10);

— mud applications to the collar zone (38–39°C, 10–15 min, in a day, N8–10);

— sea bathings at the water temperature not lower than 22°C;

— morning hygienic exercises and other forms of exercise therapy.

**Diabetes mellitus**

— therapeutic dosed walking. The extent of the route for children of 7–9 years old is from 1 to 2 km, children aged 10 to 14 — 1.5–3 km. Walking is at the average rate (60–80 steps per min), it is provided from 3 to 5 stoppages for rest for 10–15 min;

— massage of the arms, legs, back, abdomen, buttocks;

— climatotherapy:

a) air baths with heat loss to 15 kcal/m$^2$ at the equivalent effective temperature (EET) 19°C and higher, subsequently the duration of procedures increases to 30 min;

b) solar baths of diffuse radiation from 1 to 4 therapeutic doses;

c) bathing in the reservoirs and sea bathings (at the temperature of 22°C and higher. EET is not lower than 17°C);

— general sodium chloride baths (20 g/l, 36–37°C, duration from 8 to 12–15 min, N10);

— pearl baths (36–37°C, 8–10 min, daily or in a day, N10–12);

— iodide-bromine baths (36–37°C, 8–15 min, daily or in a day, N10);

— drinking of the slightly mineralized water on the basis of 3–5 ml per 1 kg of the body mass, 3 times a day, taking into account the secretory function of the stomach;

— mud therapy, application to the extremities (38–40°C, 12–15 min, in a day, N8–10);

— electrophoresis with 0.25% solution of zinc sulfate to children aged from 4 to 12 or 1% solution to children of 13–14 years old, the position of the electrodes by Vermel;

— Vermel electrophoresis — 1.5–2.5% solution of copper sulfate (8–12 min, daily or in a day, N8–10);

— electrophoresis with 25% solution of potassium chloride (current strength is 2–4 mA, 6–8 min, daily or in a day, N10);

— SMC to the region of the pancreas, the collar region (in the alternating regimen, III and IV work regimen, the depth of modulation is 50–75%, frequency is 70 Hz, current strength — 10–40 mA, 5 min in each work regimen, daily, N10–12);

— electric sleep (5–10 Hz to 15 Hz, current strength — 0.05 mA/cm, 15–30 min, daily or in a day, N8–10);

— MRT (millimeter microwaves, therapeutic frequency is 58, 50–68, 55 Hz, the power of radiation is 0.01–5 mWt/cm$^2$, 20 min, N10).

## 10.5. The Methods of Physiotherapeutic Immodulation

The normalization of the state of the immune system determines the effectiveness of treatment of a number of diseases in children to a considerable degree (bronchial asthma, recurrent bronchitis, prolonged pneumonia, atonic dermatitis, chronic tonsillitis and adenotonsillitis, rheumatism, polyarthritis and others) that is caused by high lability of the processes of immunogenesis in them. However, the application of the immunocorrecting preparations can aggravate the immune imbalance because of the possible allergic reaction or inadequate immune response. Whereas therapeutic physical factors exert the physiological regulated influence, and they can be widely used in the pediatric practice (Table 5).

Talbe 5. **Recommendations for administration of physiotherapeutic factors according to the age**

| Method (factor) | The age of application |
|---|---|
| General galvanization and electrophoresis with drugs | 2 years old |
| Local galvanization and electrophoresis with drugs | 4–6 weeks after birth, in some cases — from the first days of life |
| Electrosleep therapy, central electroanalgesia | 2–3 years old |
| Diadynamotherapy | 3 years old |
| Therapy with sinusoid modulated currents (amplipulse, stimulotherapy) | 3 months, in some cases — from the first days of life |
| Interference therapy | 3 years old |
| Electrostimulation | 3–6 months |
| Transcutaneous stimulation | 1–2 years old |
| Local d'arsonvalization | 2 years old |
| Ultratone therapy | 1 month |
| Inductothermy | 5 years old |
| UHF inductothermy | 1–2 years old |
| UHF therapy | From the first days of life |
| Microwave therapy | 1–2 years old |
| SWF therapy | 6 months |
| General franklinization | 8–10 years old |
| Local franklinization | 3 years old |
| Aeroionotherapy | 1–2 years old |
| Infrared and visible irrradiation | 1 month |
| Ultraviolet irradiation (general) | 1 month |
| Ultraviolet irradiation (local) | From the first days of life |
| Laser therapy | 6 months |
| Ultrasound therapy | 2–3 years old |
| Vibration therapy | 2–3 years old |
| Hydrotherapy | From the first days of life |
| Underwater douche-massage | 2 years old |
| Underwater traction | 10–12 years old |
| Hydrokinesitherapy | From the first days of life |

*End of table 5*

| Method (factor) | The age of application |
|---|---|
| *Baths:* | |
| Aromatic and medicinal | 1–3 months |
| Turpentine | 5–7 years old |
| Carbonic | 4–5 years old |
| Oxygen | 2–3 years old |
| Nitric | 2–3 years old |
| Pearl | 2–3 years old |
| Bromine | 1 month |
| Sodium chloride with low concentration of NaCl | 5–6 years old |
| Hydrosulfuric | 5–6 years old |
| Radon | 5–6 years old |
| Brine | 5–6 years old |
| Intake of mineral waters | 2–3 years old |
| Paraffin therapy | From the first days of life |
| Ozokerite therapy | 6 months |
| General mud therapy | 8–10 years old |
| Local mud therapy | 2–3 years old |
| Sauna | 3–5 years old |
| Speleotherapy | 2–3 years old |

The following procedures have the most pronounced immunomodulating effects:

— normobaric hypoxic therapy;

— aeroionotherapy;

— UV-irradiation, alternating the interscapular region (1–2 biodoses) and upper third of the breastbone (1–3 biodoses) in a day increasing dose of each field to 3 biodoses, N6–8;

— general UFI according to the main scheme, N12–15;

— red laser-therapy to the region of the thymus projection, the density of power flow is 0.5 mWt/cm$^2$, 5 min, the total radiation dose is 360–400 J, N9–10, daily or 5–6 times a week;

— ozone therapy: the intravenous introduction of the ozonized physical solution (100–200 ml), the concentration of ozone is 1–3 g/ml, 4–5 proce-

dures, in a day or rectal insufflations of gaseous ozone oxygen mixture (50–200 ml), concentration of ozone is 5–30 g/ml, in a day or twice a week, N5–8;

— aerosol therapy: lysozyme (0.5%), prodigiozan (0.02–0.04%), nucleate of sodium (1%, 7 years old — 0.05 dg, older — 0.1 dg), tincture of aralia, ginseng, eleuterococcus, extract of aloe (0.25–0.5 ml), daily, N5–10, levamizol (0.01%, 3–4 procedures with an interval of 10–14 days);

— intracutaneous laser irradiation of the blood (10–20 min, in a day or twice a week, N 6–8);

— ILIB (helium — neon laser), light guide with the diameter of 0.3–0.5 mm, irradiation at the output of the light guide is 0.6–1.0 mWt, the exposure time is 15-20 min, in a day or twice a week, N5–7;

— electrophoresis with magnesium sulfate (5%), 10–15 min, N8–10.

## Control Questions

1. What are the peculiarities of physiotherapy in children and adolescents?
2. Name the main indications, contraindications and age limitations for giving physiotherapy in children and adolescents.
3. Name the main therapeutic physical factors, which are used in children after acute respiratory diseases.
4. Name the main therapeutic physical factors, which are used in children with diseases of the respiratory organs.
5. Name the main therapeutic physical factors, which are used in children with gastroenterological diseases.
6. Name the main therapeutic physical factors, which are used in children with diseases of the nervous system.
7. Name the main therapeutic physical factors, which are used in children with diseases of the locomotor apparatus.

## Control Tests

1. While administrating physiotherapy to children of early age it should be taken into consideration that the skin possesses:

A. Great hydrophilic property and increased adsorption power
B. Little hydrophilic property and absorption power
C. Increased brittleness and dryness
D. Small vascularization
E. A large number of elastic fibers

2. Children of breast-feeding age (up to 1 year of life) may be administered the enumerated methods of physiotherapy except:

A. Electrophoresis with drugs
B. Ultraviolet irradiation in suberythemal dose
C. General franklinization
D. UHF-therapy
E. Paraffin-therapy

3. In treatment of the sick child electrosleep therapy may be administered:

A. At the 1st month of life
B. From 3 months of life
C. From 3 years old
D. From 5 years old
E. From 7 years old

4. A premature infant is administered UHF-therapy with the exposure rate up to:

A. 5 Wt
B. 15 Wt
C. 20 Wt
D. 40 Wt

5. In neurocirculatory dystonia of the hypotonic type children are administered:

A. Electrophoresis with bromide by Vermel
B. SHF-therapy on the collar zone
C. Electrophoresis with mesaton endonasally
D. Electrophoresis with caffeine on the collar area
E. Diadynamotherapy on the area of the cervical sympathetic nodes

*Appendix 1*

# COMPATIBILITY AND SEQUENCE IN ADMINISTRATION OF PHYSICAL THERAPEUTIC AGENTS

There are two basic types of combined physical therapeutic agents: associated and combining.

The associated physical influence is a simultaneous application of two or three physical and nonphysical medical influences (galvanoinductothermy, vacuum-electrophoresis with medicinal substances, etc.).

The combining physical medical influence is a consecutive administration of several physical therapeutic agents.

Possible advantages of associated uses of physical and medicinal agents are the following:

— increased treatment efficacy with smaller adaptation of the tissues to the action of one factor, the synergy and potentiation are more pronounced;

— a combination of influence in weaker dosages with better tolerances of procedures;

— economy of time of the patient and personnel;

— greater profitability of treatment courses.

Besides a combination of proper physical factors, it is necessary to take into consideration inclusion of ET, massage, climatic medical influences, inhalation, remedies, procedures of psychotherapy (autotraining, hypnosis, etc.) and roentgen therapy into medical complexes.

It is also necessary to consider different variants of the combination of various physical therapeutic agents:

— combination with influence on the same skin zone, organ or system;

— combination with influence on different zones, organs or systems (in treatment of main and concomitant diseases);

— combination with various time intervals (without essential interval, in 1.5–2 hrs, daily, in a day, etc.);

— combination of physical factors various in force (two strong, strong and weak or weak);

— combination of factors with unequal orientation of influence (antagonistic, synergic, etc.).

## Variants of Combination

There are the following combination types:

a) combination of physical factors;

b) combination of physical factors with ET and massage:

c) combination of physical factors with climatic therapeutic procedures;

d) combination of physical and medicinal agents;

e) combination of physiotherapeutic agents and roentgen radiation therapy;

f) combination of physiotherapeutic agents with psychotherapy (for example, light or other heat with auto-training).

## Principles of Combination

There are no absolutely incompatible procedures in physiotherapy. By varying methodical methods (sequence, intensity, duration, localization) it is possible to administer two any factors reasonably and purposefully. However, there are physical factors which combination is simply inexpedient, and they are not practically combined (diadynamic currents and SMC). There are factors which possibility of combination is a subject to study (V. M. Bogolyubov and V. S. Ulaschik, 1985).

**Synergy** is a unidirectional influence of physical factors with their application either to the same, or to various zones, organs and systems (synergic, but a different mechanism of medical action).

**Sensitization** is a preparation of the tissue, organ or organism of one medical factor to more effective influence of another.

**Adequacy.** The administered physical factors should not exceed adaptation resources of the tissues, organs, and systems of an organism (not to overload an organism with excessive amount of influence).

**Combination of local and general influences** (for intensification of local focal reaction). Local procedures should be the first to be made in administration at the same day.

**Antagonism** is an application of differently directed influences:

a) for weakening by one factor the undesirable effects of action of another factor;

b) for rendering training influence (contrast procedures).

**Sparing influence**. The purpose of combining of some kinds of influences can be decrease of intensity of each of them, a shortening of procedure duration, and course of treatment.

## Rules of Combination

1. If one influence prepares the tissue, organ (system) for more effective influence of another, the second one can be given after the former without essential interval.

2. An interval between procedures not provided by this should make not less than 1.5–2 hrs.

3. Two procedures with the general influence on an organism are not administered at the same day, especially, if they are related to strong ones (permitted for weak ones).

4. As a rule, it is not recommended to administer more than two physical medical procedures at the same day, the third mild one on the other organ or system can be administered on a special occasion.

5. Local physiotherapeutic influences are administered, as a rule, before the general procedures.

6. Local UV-irradiations in erythemal dosages are not administered after hydrotherapeutic procedures (in order to prevent, in particular, maceration of the skin).

7. Electrophoresis with many medicines with the purpose of their greater and deeper introduction is carried out at once after the following local procedures: ultrasound through water (but not oil), microwaves, inductothermy, paraffin-ozokerite applications, and local baths.

8. Electrophoresis with medicinal substances in order to create steady dermal depot of medicines is recommended to carry out before the specified procedures with application of adrenaline, cold and it is desirable to make it in different skin zones.

9. The general physiotherapeutic procedures are not given on the days of patients' examination with loading.

10. While carrying out complex treatment by physical factors it is necessary to consider whether it is given without dismissal of active work or with dismissal. In the first case a 1.5–2-hour interval between the termination of work and physiotherapeutic procedures is established.

## Rules of Combination of Climatic and Physiotherapeutic Procedures

1. Procedures of apparatus physiotherapy should be given, as a rule, after climatic (especially local thermal) ones with an interval of about 2 hrs. Water, mud, ozokerite, paraffin, etc. procedures are also given after climatic ones (after air and solar baths).

2. Solar baths are more often taken before sea and other bathings.

3. On the days of sea (estuary, river) bathings it is not recommended to give thermal therapeutic procedures, or they are carried out after bathings with an interval of many hours.

4. It is useful to combine climatic influences with ET (climate-kinesitherapy), they are of high tempering and medical effect.

5. It is expedient to carry out simultaneously mud and climatic therapy — the egyptian technique of mud therapy or fangotherapy (peloid therapy) methods of solar heating.

### The Influences Incompatible within the Limits of one Procedure

1. Technically incompatible (for example, light and many hydrotherapeutic procedures).

2. Opposite in the mechanism of action (for example, cold and inductothermy).

3. Procedures causing overloads of the tissues, organ, system, organism.

### The Procedures Incompatible at the Same Day

1. The procedures causing generalized reaction of an organism, influencing the general reactivity, bringing about marked fatigue or exaltation of the patient. In particular, electrosleep is incompatible with other electroprocedures of the general influence on an organism (general franklinization, etc.).

2. Procedures of the unidirectional action, but surpassing adaptation abilities of the organ or tissue: in particular, erythemal influences and intensive thermal procedures.

3. Differently directed procedures by the mechanism of medical action which do not provide one purpose: sedative and exciting, cold and hot procedures.

### In the course of treatment do not combine

1. Intensive water, mud and electroprocedures with acupuncture.

2. Sea therapy with intensive thermotherapy (especially mud therapy).

3. Air-therapy in pronounced cold loads with intensive peloid therapy.

4. Close procedures by their physical characteristics: solar baths and UV-irradiations, two high-frequency procedures (inductothermy and microwaves).

5. Massage and erythemal UV-therapy of the same areas.

6. Procedures which can result in damage of the tissue are incompatible in the course of treatment: erythemotherapy, galvanization, massage, local d'arsonvalization in the same skin areas.

*Appendix 2*

# GENERAL AND INDIVIDUAL INDICATIONS AND CONTRAINDICATIONS TO SANATORIUM TREATMENT

## General Indications to Sanatorium Treatment

1. Patients demanding long-term rehabilitation treatment with application of native and preformed medical agents first of all are referred to health resorts after acute diseases, traumas and operations under condition of self-service. Possible general and individual contraindications should be taken into consideration (see below).

2. Patients (both adults and children) can be referred to sanatorium treatment with various forms of chronic diseases of the cardiovascular and nervous systems, organs of digestion, respiration, locomotor apparatus, diseases of the kidneys, the urinary tract, male and female reproductive organs, skin, metabolism, patients with tuberculosis (to specialized sanatoria) who are indicated to have application of natural medical agents. Basically, persons are referred there with I and II stages of diseases for treatment, termination of advanced pathological process and prevention of relapses of the disease. The general and individual contraindications should be considered.

More detailed information is given in special methodical references of Health Ministry of Ukraine (Kiev, 1995).

## General Contraindications Excluding Reference of Patients to Health Resorts and Local Sanatoria

1. All diseases in the acute stage, chronic diseases in the stage of exacerbation and complicated by acute purulent processes.

2. Acute infectious diseases before the termination of the isolation period.

3. All venereal diseases in the acute or infectious form.

4. Mental diseases. All forms of drug abuse and alcoholism. Epilepsy.

5. All diseases of blood in the acute stage and stage of exacerbation.

6. Cachexia of any origin.

7. Malignant neoplasms.

*Note.* Patients after radical treatment for malignant neoplasms (surgical, radiation, chemotherapy, complex) can be referred only to local sanatoria for generally strengthening treatment in satisfactory general condition of the organism.

8. All diseases and conditions demanding hospitalization, including surgical intervention; all diseases in which patients are not capable of independent movement, requiring constant special care.

9. Esinococcus of any localization.

10. Frequently repeated or profuse bleedings.

11. Pregnancy beginning from the 26th week.

a) for balneopelotherapy in case of gynecological diseases;

b) for treatment of extragenital diseases by radon baths;

c) inhabitants of plains referred to the mountain health resorts located at the height of more than 1000 m above the sea level.

12. All forms of tuberculosis in the active stage to any health resorts and sanatoria of nontuberculosis structure.

## Individual Contraindications

### Diseases of the Circulatory System

1. Rheumatic endomyocarditis in the active phase (II–III degree of activity).

2. Abramov — Fiedler's myocarditis and the one close to it in severity.

3. Atherosclerosis of the lower extremity vessels with decompensation of peripheral circulation, presence of ulcers and gangrenes.

4. Obliterating thromboangitis (endarteritis) prone to generalization, in concomitant thrombophlebitis, in presence of fresh ulcerations, gangrenes.

5. A clotting disease.

6. Thrombophlebitis for 1–2 years after eradication of the septic process for all health resorts and local cardiologic sanatoria.

7. The circulatory insufficiency over II A stage — for all health resorts and local cardiologic sanatoria; over I stage — for balneal, mud and mountain health resorts.

8. Complete atrioventricular blockade, polytopic, frequent, group extrasystole — for all health resorts and local cardiologic sanatoria.

9. Ciliary arrhythmia with circulatory insufficiency over II A stage, par-

oxysmal tachycardia, complete blockade of the right and left His' bundle — for balneal, mud and mountain health resorts.

10. Ischemic heart disease: a) acute myocardial infarction; b) attacks of usual exertional angina pectoris with circulatory insufficiency over I stage with rhythm disturbances (III class), frequent attacks of exertional and rest angina pectoris (IV functional class) or the phenomena of the left ventricular failure (cardiac asthma) — for all health resorts and local cardiologic sanatoria.

11. Hypertension with the malignant course, hypertension of III stage with recent myocardial infarction or insult, in circulatory insufficiency over II A stages, in presence of serious disturbances of cardiac rhythm and conduction, nitrogen-excretion kidney dysfunctions — for all health resorts and local cardiologic sanatoria, hypertension over II stage — for all health resorts.

## Diseases of the Digestive Organs

1. All diseases of the digestive organs in the phase of exacerbation.

2. A cicatrical stenosis of the esophagus and intestines with disturbance of patency; structure of the general biliary duct and the gall-bladder duct.

3. A peptic ulcer of the stomach and duodenum in the phase of exacerbation, as well as a peptic ulcer complicated by a pyloric stenosis, repeated bleedings which have occurred for the last 8–10 months due to ulcer penetration; suspicion on malignancy of the stomach ulcer, Zollinger — Ellison's disease.

4. Gastritis: rigid, antral, as well as stomach polyps, Ménétrier's disease (hypertrophic gastritis).

5. Complications after operations on the stomach (nonhealing postoperative cicatrix, fistulas, a syndrome of the adductor loop, a so-called vicious circle, damping and hypoglycemic syndrome in the severe degree, atony of the stomach stump, a round ulcer of the small bowel in the phase of exacerbation with tendency to bleeding and penetration into the adjacent organs, exacerbation of chronic postoperative gastritis, pancreatitis, cholecystitis, hepatitis, the severe form of postvagotomic diarrhea).

6. Coloenteritis with pronounced malnutrition (cachexia).

7. Chronic dysentery, nonspecific ulcerative colitis, chronic colitis with extensive ulcerative or erosive process in the rectum or sigmoid, revealed by proctosigmoidoscopy or colonoscopy, as well as bleeding hemorrhoids, polyp or polyposis of the intestine.

8. Cholelithiasis accompanied by attacks of hepatic colic.

9. The residual phenomena of virus hepatitis (Botkin's disease) with signs of incomplete activity of the process (presence of painful, dyspeptic, asthenic syndrome) and considerable deviations of parameters of functional

hepatic assays, including the level of tissue enzymes ALT-AST in the blood; chronic active (progressing) hepatitis of any etiology.

10. Cirrhosis of the liver.

11. All forms of hepatitis.

12. Severe forms of pancreatitis. Patency disturbances of the pancreatic duct.

## Diseases of the Nervous System

1. Diseases of the nervous system in the acute period of the disease, as well as accompanied by sharp disturbances in the motor sphere (the paralyses interfering into independent movement) and considerable dysfunctions of the pelvic organs (except for the patients referred to sanatoria for treatment of traumas and diseases of the spine and spinal cord).

2. Amyotrophic lateral sclerosis.

3. Syringobulbia, myelosyringosis, multiple sclerosis with progredient course with the motor disturbances interfering into independent movement and self-service.

4. Consequences of traumas and diseases of the spinal cord:

a) complete fracture of the spinal cord;

b) traumatic cachexia;

c) the acute or chronic ischuria demanding constant catheterization of the bladder;

d) chronic osteomyelitis demanding surgery;

e) chronic pyelonephritis with sharply pronounced dysfunction of the kidneys of different origin;

f) urosepsis;

g) drug abuse.

5. Diseases of the nervous system with mental disturbances.

6. Tabes with the signs of ataxia, cachexia and atrophy of the optic nerves.

7. Consequences of serious traumas of the skull with considerable omissions of motor functions with frequent epileptiform attacks, with mental disturbances.

8. Psychopathies, psychosis, serious hypochondriacal, depressive, obsessions and other psychopathic conditions.

9. Epilepsy with frequent attacks.

10. Arachnoiditis — the adhesion-cystic form, as well as forms with epileptic attacks.

11. Tumours of the nervous system.

## Diseases of the Osteomuscular System

1. Severe forms of bone and joint affections with plentiful discharge, severe general phenomena (hectic temperature, sharp cachexia) or amyloidosis of internal organs.

2. Polyarthritis with progressing process in the joints, with ankylosis, contractures, etc. in irreversible changes in the joints and in disability to self-service.

3. Serious deformations of the joints with secondary synovitis with loss of independent movement.

4. Chronic osteomyelitis in presence of large sequestrations or a large foreign metal body in the osteomyelitic focus (presence of small metal splinters in the surrounding soft tissues is not a contraindication for resort therapy).

5. Septic forms of rheumatoid polyarthritis, pseudorheumatism with systemic affections (visceritis).

## Diseases of the Respiratory Organs

1. Chronic diffuse bronchitis, chronic pneumonia, pneumosclerosis, emphysema of the lungs, pneumoconiosis (dust diseases), accompanied by pulmonary heart over IIA stage (for health resorts), II stage (for health resorts and local sanatoria).

2. Acute bronchitis, chronic bronchitis and pneumonias in the phase of exacerbation (with the increased body temperature, high ESR and other changes of haemogram).

3. Bronchiectasis, chronic abscesses in sharp cachexia of patients, the increased body temperature accompanied by discharge of plentiful purulent sputum, hemoptysis.

4. A spontaneous pneumothorax, chronic relapsing form of thromboembolism of the pulmonary artery, solitary cysts of the lung of big size, cystic hypoplasia of the lung with frequent outbreaks of suppuration, acute dry (fibrinous) and exudative pleuritis.

5. Bronchial asthma with recurrent and serious attacks of moderate severity, without stabilization of the process even against the background of intake of small doses of hormones.

6. After surgery on the lungs in presence of tracheobronchial fistulas, after noneffective surgeries for suppurative processes, in presence of pleural exudates.

### Diseases of the Ear, Nose and Throat

1. All diseases of the ear, nose and throat in the acute stage and stages of exacerbation complicated by acute purulent processes.
2. Chronic epimesotympanitis.
3. Ozena.

### Diseases of the Female Genitalia

1. Malignant neoplasms and suspicion on their presence.
2. Postabortion period (up to the first menses).
3. Thermal treatment — mud and balneotherapy is contraindicated in:
a) bleeding erosion of the cervix of the uterus;
b) polyps of the uterine cervix;
c) the diseases accompanied by uterine bleedings;
d) cystoma and cyst of the ovaries;
e) hysteromyoma, endometriosis and mastopathies;
f) sactosalpinx;
g) colpocystoabdominal fistula;
h) precancerous diseases of the female genitals as well as a condition after surgery for malignant tumours.
4. Mud and balneotherapy (except radon and iodide bromine waters) are contraindicated in hyperestrogenism.

### Disturbances of Metabolism and Disease of the Endocrine System

1. Primary neuroendocrinal (hypothalamus-pituitary) obesity, secondary cerebral, endocrine obesity of organic genesis and any forms of obesity of IV degree in circulatory insufficiency over II A stage.
2. Diabetes mellitus of the severe degree with cachexia, pronounced ketoacidosis, with signs of precomatous conditions as well as in labile course (frequent hypoglycemic conditions).
3. Thyrotoxicosis of the severe degree as well as with marked complications (thyrocardiac heart, etc.).

### Diseases of the Skin

1. All diseases of the skin in acute and subacute stages.
2. Vesical dermatosis.
3. Fungal diseases of the sculp, smooth skin, nails*.

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* In affection of the nail plates patients are allowed to refer to somatic sanatoria if they receive corresponding course of treatment, and fungi are not found microscopically.

4. Parasitogenic diseases of the skin — scabies, etc.

5. Pustular diseases of the skin.

6. Reticulosis of the skin (hemoderma).

7. Lupus erythematosus, photodermatosis, late dermal porphyria, pigmental xeroderma.

## Diseases of the Urogenital System

1. Chronic diseases of the kidneys (chronic glomerulonephritis, chronic pyelonephritis) with pronounced phenomena of chronic renal failure, with high arterial pressure (exceeding 180 mm Hg) or neuroretinitis.

2. Sclerosis of the kidney with signs of chronic renal failure.

3. Hydronephrosis: a cyst of the kidney (plural, solitary), complicated by chronic renal failure.

4. A nephrotic syndrome in amyloidosis with pronounced edemas and signs of chronic renal failure.

*Note.* Patients suffering from chronic nephritis or amyloidosis of the kidneys without phenomena of cachexia, pronounced edema are permitted to be directed to local sanatoria in satisfactory general condition if the basic disease is indicated for treatment in the given sanatorium.

5. Macroscopic hematuria of any origin.

6. All urological diseases in the acute stage and chronic diseases in the stages of exacerbation complicated by acute purulent processes.

7. Urolithiasis in presence of the stones demanding surgical excision.

8. Structure of the urethra.

9. Adenoma of the prostate of II and III degrees.

10. The wrinkled bladder of any etiology.

11. Urinary fistulas of any etiology.

*Note.* Patients with diseases of the kidneys (of moderate and severe gravity) are contraindicated to be referred to health resorts with hydrosulphuric waters.

## Diseases of the Blood and Chronic Intoxications

1. All diseases of the blood system in the acute stage and stage of exacerbation.

2. A radiation disease of III degree as well as with marked manifestations of vegetative dystonia, diencephalic syndrome (frequent and severe crises).

3. Chronic intoxications of the severe degree, especially in presence of the pronounced anemia and affections of the nervous system (encephalopathy, paralysis). Lingering course of the rehabilitation period after acute poisoning with relapses.

## Diseases of the Eye and its Appendages

1. Acute infectious diseases of the eye appendages representing danger of infection to the surrounding people.

2. All diseases of the eyes in the acute stage, the stage of exacerbation or latent course.

3. Consequences of serious contusions and penetrating wounds of the eye (within a year after a trauma).

4. Conditions after surgery on the eyeball (three months after the surgery in absence of postoperative complications).

5. Acute circulatory disturbances in the retina and optic nerve (clots and embolisms of the central retina, central vein of the retina and its branches).

6. Serious affections of the retina (retinopathy), optic nerve and vessels against the background of systemic diseases (arterial hypertension, atherosclerosis, etc.).

7. Degenerative processes in the retina and vascular membrane of the eye accompanied by hemorrhages.

8. Complicated myopia with changes on the eye fundus.

9. Detachment of the retina, fresh, unoperated or successfully operated during a year after the surgery.

10. Neoplasms of the eye and its appendages.

11. Glaucoma in the acute stage (attacks), noncompensated glaucoma in any stage of the disease, absolute glaucoma, secondary noncompensated glaucoma and in exacerbation of the process.

*Appendix 3*

# BASIC HEALTH RESORTS OF UKRAINE

| The name of the health resort | The main medical factors of the resort* | The basic indications to a health resort |
|---|---|---|
| 1) Alupka (the Crimea) | A curative climate | Pulmonary tuberculosis |
| 2) Alushta (the Crimea) | A curative climate, sea water (baths) | Nonspecific diseases of the organs of respiration. Neurosis and neurosis-like conditions |
| 3) Berdyansk (Zaporozhye region) | Medical muds, mineral waters, estuary brine, the sea water, a favorable climate | Diseases of the locomotor, nervous and cardiovascular systems, female and male sexual organs, organs of digestion |
| 4) Berezovsk mineral saters and Ray-Yelenovka (Kharkov region) | Siliceous poorly-mineralized waters. A favorable climate | Diseases of the organs of digestion, urogenital system, metabolism. Neurosis and neurosis-like conditions |
| 5) Vorsel (Kyiv region) | A favorable climate for the vascular system | Diseases of the cardiovascular system. Neurosis and neurosis-like conditions, vegetative vascular dystonia |

* In all health resorts besides local natural medical factors imported medical muds, ozokerite, mineral medical waters, apparatus physiotherapy, hydrotherapy, medical inhalations, ET, massage, and psychotherapy are applied taking into consideration the basic structure of a health resort.

| The name of the health resort | The main medical factors of the resort | The basic indications to a health resort |
|---|---|---|
| 6) Evpatoria and Saki (the Crimea) | Medical muds, a curative climate, sea water, estuary brine, mineral waters (from wells) | Diseases and traumas of the locomotor, nervous system, female and male sexual organs, organs of respiration, diseases of the skin |
| 7) Zakarpatye region | A favorable climate, numerous mineral waters | Diseases of the cardiovascular system, organs of digestion, nervous system and blood (Verkhovina) |
| 8) Koncha-Zaspa (Kyiv region) | A favorable climate, mineral waters | Diseases of the cardiovascular and nervous systems, organs of respiration |
| 9) Kuyalnik (Odessa) | Medical muds, mineral waters, estuary brine, a favorable climate | Diseases and traumas of the locomotor, nervous system, urogenital organs, ENT-organs |
| 10) Livadia, Miskhor, Gaspra (the Crimea) | A favorable climate | Diseases of the organs of respiration and nervous system |
| 11) Mirgorod (Poltava region) | Mineral waters, peat mud, a favorable climate. | Diseases of the organs of digestion with the lowered secretory function, endocrine diseases, pathology in pregnant women |
| 12) Morshin (Lvov region) | Mineral waters, peat mud, medical ozokerite, a favorable climate | Diseases of the organs of digestion |
| 13) Odessa | A favorable climate, a medical mud, mineral waters, sea water | Diseases of the locomotor, nervous system, urogenital organs, eyes, organs of digestion and respiration |

| The name of the health resort | The main medical factors of the resort | The basic indications to a health resort |
|---|---|---|
| 14) Ochakov | A favorable climate, sea water, medical mud | Diseases of the organs of respiration, disease of the locomotor system, neurosis |
| 15) Polyana (Zakarpatye region ) | Mineral waters, a favorable climate | Diseases of the organs of digestion and cardiovascular system, diseases of blood (sananorium Verkhovina) |
| 16) Puscha-Voditsa (Kyiv region) | A favorable climate | Diseases of the organs of respiration and nervous system |
| 17) Sergeevka (Odessa region) | Medical mud, estuary brine, sea water, the mineral water, a favorable climate | Diseases of the locomotor, nervous system, urogenital organs, ENT-organs |
| 18) Slavyansk (Donetsk region) | Medical mud, estuary brine, a favorable climate | Diseases and damages of the locomotor, nervous system. Urogenital organs |
| 19) Slavyanogorsk (Donetsk region) | A favorable climate. | Diseases of the organs of respiration and nervous system |
| 20) Truskavets and Skhodnitsa (Lvov region) | Mineral waters, ozokerite | Diseases of the kidneys and urinary tract, organs of digestion |
| 21) Khmelnik (Vinnitsa region) | The radon water, a favorable climate | Diseases of the locomotor, nervous and cardiovascular systems |
| 22) Feodosiya | A favorable climate, medical mud, sea water | Diseases of the organs of respiration, cardiovascular system, organs of digestion |
| 23) Yalta | A favorable climate, mineral water, sea water | Diseases of the organs of respiration and nervous system (neurosis, vegetative vascular dystonia) |

*Appendix 4*

# BASIC HEALTH RESORTS OF THE WORLD

## EUROPE

### Baden-Baden

The basis of the therapeutic natural resources of Baden-Baden is composed of more than 20 thermal springs of the mineral waters whose temperature reaches 68°C. There are the unique springs of slightly radioactive radon waters among the numerous springs of health resort, which are widely used in the form of baths and cavity irrigations for treating the diseases of the heart and vessels, joints and muscles, peripheral nervous system, female and male sexual organs and skin, consequences of injuries and medical rehabilitation after operations.

### Vichy

The world glory of the health resort is 15 natural springs of subthermal and thermal (temperature of 17–66°C radon carbonate hydrocarbonate-sodium moderately mineralized waters with a large number of microelements. Six of them (Selestin, Hopital, Grand-Grille, Loukas, Lardi, Dome, Chaumel and others) are used for the drinking treatment, inhalations and irrigations. The spring Source Mesdames contains maximum quantity of carbonic acid dioxide, and Chaumel — minimum. The famous bicarbonate-sodium mineral water of Vichy, which stimulates formation and transport of bile in the bowels, is well known in the world. It is successfully used for drinking treatment in the diseases of the liver and bile tracts, bowels, kidneys, with diseases of the endocrine system and disturbances of metabolism. A significant quantity of water is bottles, and they are exported in many countries of the world.

### Karlovi Varu

The basic natural therapeutic resources of the resort are 12 thermal (temperature of 42–73°C) springs of the moderately mineralized carbonate hydrogen sulfide sulfate-bicarbonate — chloride sodium potassium calcium mineral waters, which contain ions of magnesium, iron, lithium, bromine, fluorides and silicic acid. These springs brought world famous reputation to the resort. They differ little in their chemical composition, and are distinguished, mainly, by the temperature of waters.

### French Riviera

Seaside warm and relatively dry climate of the Azure shore possesses medicinal properties.

The health resorts of the Northern Mediterranean (French and Italian Riviera) are attractive in the summer period: it is comfortable here, warm, dry, quiet, not stuffy, and the sea water is warm. They are characteristic of prolonged warm autumn, and very soft but colder winter than on the Canary Islands.

Year-round aero- and heliotherapy and sea bathings are indicated for the treatment of patients with the functional disorders of the nervous system, diseases of the respiratory organs, cardiovascular system, kidneys and disturbances of metabolism.

### Italian Riviera

The seaside line is covered with rich and diverse (palm, agave, mimosa, citrus fruits and other) subtropical vegetation. The mild climate, picturesque landscapes, numerous sandy beaches and luxuriant vegetation contributed to transformation of Italian Riviera into the known health resort region and the zone of year-round leisure and tourism. The dry and warm climate of the coast is favorable for treatment of patients with diseases of the lungs, functional disorders of the nervous system, skin, gynaecological diseases and obesity.

### Crete

The favorable Mediterranean climate with very soft winter (the mean temperature of January is 12.2°C) and the hot dry summer (the mean temperature of July is 25.4°C), abundance of sunny days (300 days in the year) contributed to the transformation of Crete into one of the most widely known health resorts of Europe, intended predominantly for health-improvement leisure.

### Cyprus

Along with the climatotherapy hydropathy, apparatus physiotherapy are widely used at the health resort predominantly for patients with the unspecific diseases of the respiratory organs, diseases of the cardiovascular system, kidneys, locomotor organs, functional diseases of the nervous system, disturbance of metabolism.

## AFRICA

### Egypt

The basic natural therapeutic factor of the health resort is dry hot desert climate and sea coast with very soft winter (mean temperature of January is 16°C) and hot summer (mean temperature of July is 35°C), extremely low level of sediments (about 30 mm per year) and very small relative humidity (from 34.5% in March to 49% in December). The water in the Red Sea is crystal clear and very warm. The temperature of water at Egypt coasts rarely descends below 18°C even in winter, and in summer it reaches 27°C. This is one of the most salt seas in the world.

Climatotherapy is indicated in chronic diffuse glomerulonephritis, diseases of the respiratory organs and peripheral nervous system.

Among the most known and popular health resorts of Egypt are Charm-el-Sheikh, Khurgadu and Nuveybu.

## ASIA

### The Dead Sea

The Dead sea is located on the border of Jordans and Israel, 25 km from Jerusalem and 80 km from Tel Aviv at the foot of the fantastically beautiful rocky mountains with numerous canyons. It is a unique source of natural therapeutic resources.

### Antalya

The largest climatotherapeutic health resort is located in the south of Turkey on the Mediterranean coast. Antalya is the center of Turkish Riviera, the most popular health resort zone, which is stretched from Tekirova to Machmutlara with the main health resorts — Kemer, Belek, Side, Alanya, each of which has its charm and variety of the landscapes: infinite beaches, the snow-covered apexes of the mountain ranges, whimsically cut rocky

shores, the secluded bunches and quiet bays. According to the version of UNESCO the Mediterranean coast of Turkey with the length of 800 km is the ecologically cleanest place in the world, and the region of Antalya with unique flora and fauna is declared a natural preserve.

## AMERICA

### Florida

The climatotherapeutic resources of the sea coast of Florida are favorable for treatment of patients with functional disturbances of the nervous system, unspecific diseases of the respiratory organs. Being center of one of the largest health resort regions in the world, the health resorts of Florida are more known as the places of elite health-improvement leisure, entertainments and tourism. Today this is the most fashionable place in America and in the entire world — American Riviera, where more than 15 mln vacationers and tourists arrive per year.

## AUSTRALIA

### Gold Coast

Gold Coast is the seaside climatotherapeutic health resort of Australia located at the shore of the Pacific Ocean to the south from Brisbane.

Basic natural therapeutic factors are tropical climate and warm sea; they allow to make bathings, take solar and air baths. They are favorable for patients with diseases of the nervous system and respiratory organs.

# KEYS

**Chapter 1:** 1C; 2C; 3B; 4D; 5C

**Chapter 2:** 1A; 2C; 3A; 4E; 5B

**Chapter 3:** 1C; 2C; 3C; 4C; 5A

**Chapter 4:** 1B; 2C; 3D; 4C; 5C

**Chapter 5:** 1D; 2A; 3B; 4D; 5A

**Chapter 6:** 1B; 2A; 3B; 4B; 5B

**Chapter 7:** 1C; 2B; 3D; 4B; 5E

**Chapter 8:** 1D; 2B; 3C; 4B; 5D

**Chapter 9:** 1A; 2B; 3E; 4E; 5D

**Chapter 10:** 1DA; 2C; 3C; 4B

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# INDEX

# LIST OF ABBREVIATIONS

AMF — alternating magnetic field
AP — arterial pressure
BAP — biologically active points
CC — chronic colitis
CG — chronic gastritis
CM — constant modulation
CMF — constant magnetic field
CMMF — complex modulated magnetic field
CMT — constant magnetotherapy
CNS — central nervous system
CW — centimetre wave (therapy)
DDC — diadynamic currents
DMW — decimetre wave (therapy, field)
ECG — electrocardiography
EEG — electroencephalography
EF — electric field
EHF — extremely high frequency (therapy)
ELRB — extracorporal laser radiation of blood
EMF — electromagnetic field
EMR — electromagnetic radiation
ET — exercise therapy
GIT — gastrointestinal tract
HF — high frequency
HIIMF — high-intensive impulse magnetic field
HIIMT — high-intensive impulse magnetotherapy
IF — intermittent frequencies
IFP — intermittent frequencies-pauses
IHD — ischemic heart disease

ILFEMF — impulse low frequency electromagnetic field
ILIB — intravenous laser irradiation of the blood
IUV — integrated ultraviolet
LBT — local barotherapy
LFMF — low-frequency magnetic field
LFMT — low-frequency magnetotherapy
LILR — low-intensity laser radiation
LIMT — low-intensity magnetotherapy
LP — long period (current)
LUV — long-wave ultra-violet (radiation)
LVT — local vacuum-therapy
MDM — mesodiencephalic modulation
MF — magnetic field
MF — message-carrier frequency
MI — medical influence
MLT — magnetolaser therapy
MMW — medical mineral waters
MNR — monochromatic noncoherent radiation
MT — magnetotherapy
MWT — millimetre wave (therapy)
OC — one-half-period continuous (current)
OQO — optical quantum oscillator
OR — one-half-period rhythmical (current)
OW — one-half-period wave (current)
PEMF — pulse electromagnetic field
PhF — physical factor
PhT — physiotherapy
PMF — pulsating magnetic field
PU — peptic ulcer of the stomach and duodenum
RMF — running magnetic field
SHF — superhigh frequency (therapy, field)
SMC — sinusoidal modulated current
SP — short period (current)
SR — syncope rhythm (current)
SSF — supersonic frequency
SUV — short-wave ultra-violet (radiation)
SWF — short-wave frequency
TC — two-half-period continuous (current)
TENS — transcutaneous electric neurostimulation
TLRB — transcutaneous laser radiation of blood

TW — two-half-period wave (current)
UHF — ultrahigh frequency (therapy, a field)
UPP — ultraphonophoresis
US — ultrasound
USP — ultrasonic puncture
UST — ultrasonic therapy

# CONTENTS

*Бібліотека студента-медика*

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Навчальне видання

**ШМАКОВА Ірина Петрівна**
**ПРОКОПЧУК Юлія Вікторівна**
**ШАПОВАЛОВА Ганна Анатоліївна**

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Технічний редактор ***А. В. Попов***
Коректор ***О. В. Титова***
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