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**Article name:** **Физиотерепевтическое лечение язвенной болезни желудка и двенадцатипестной кишки**

# Physiotherapy of gastric ulcer and duodenal ulcer

**The review presents 69 references of current literature on the problem of gastroduodenal ulcer physiotherapy which has a good potential of impact on gastroduodenal motility, lipid peroxidation, microcirculation, physiological and reparative regeneration of epithelial and glandular cells. The choice of a physiotherapeutic method depends on the disease stage and to a less extent on location of the ulcer defect.**

**Key words: ulcer disease, factors of aggression and protection, physiotherapy**

Gastric ulcer (GU) and duodenal ulcer (DU) are one of the most complicated and most contradictory problems in gastroenterology. Regardless of all the success achieved in efforts to understand the most important aspects of ulcerogenesis, the basic reasons and mechanisms of gastric ulcer are still mysterious, as J. Cruveilhier said, and they are still not completely clarified [1]. Pathogenesis of gastric and duodenal ulcerogenesis are still regarded from the point of view of disbalance between aggressive factors of the gastric material and protective capabilities of the mucous membrane (MM), as the first ones prevail and the others weaken. It is this conception that is used as a base for the modern approaches to anti-ulcer medicated therapy which includes anti-secretory and anti-helicobacterial drugs [2] as obligatory components, The success which was achieved following this way, is indisputable. Nowadays, subtotal inhibition of acidic gastric secretion can provide with ulcerative deficiency cicatrisation within 4 weeks 93-96% of patients with DU and for 69-81% of patients with GU [1]. Use of combined schemes of eradication therapy with 3 and 4 components, allowed to decrease the quantity of early relapses of ulcer from 75-82% to 18-20% (within 6 months). Over the past 20 years, the quantity of patients with medium-severe and severe, often relapsing and complicated course of disease, has decreased from 45,8% in 1977 to 2,04% in 1997, which is connected with the use of powerful anti-secretory and anti-helicobacterial medicines [3].

Many facts have been collected which evidence about the imperfect reputation of the drugs from these 2 groups. It is referred to almost complete reduction of the gastric phase of digestion which modern anti-secretory drugs cause, as well as disorganization of its intestinal phase, exceed gastric bacterial contamination and bacterial contamination of the narrow intestine, the risk of carcinoid tumor in the gaster and high

frequency of early relapses (the symptom of ricochet) [4]. The range of negative effects of anti-helicobacterial therapy is even larger, and we do not include in this list the secondary (acquired), increasing resistance of Helicobacter pylori (HP) to antibacterial drugs used for the eradication [5-8].

There is some new information which specify and supplement the ideas about the pathogenesis of ulcer in all its aspects. Scientists' attention is focused on the problems of immune ulcerogenesis [9, 10], "oxidative" stress at ulcer [11, 12]; psychosomatic conception of disease is widely discussed [13-15], etc. The facts derived during the scientific research have a direct practical importance. For example, it is recommended to include medicines from other farmacological groups into the complex of remedial actions: immunomodulators, stimulators of angionesis, neurotropic drugs (anti-depressants, nootropics), designed to correct the disfunctions [10, 13, 16]. However, adding to the traditional schemes of triple- or quadrotherapy 2 or 3 more pharmacological drugs can contradict with the postulate of reasonable use of medical drugs, which suggests simultaneous use of maximum 3-4 drugs, because otherwise their interaction becomes impossible to control.

This way, the problem of therapy of ulcer is still far from the ultimate solution, which can be connected both with insufficient understanding of some pathophysiological aspects of ulcerogenesis, and with underestimation of the impair of general integral mechanisms of the adaptive regulation and self-regulation at different levels in pathogenesis of the ulcer as a systemic disease, which involves all the organism into the pathological process [1, 17-19].

Discussing the problem of the ulcer therapy from the systemic approach, we will find the physiotherapeutical methods of treatment very effective, because they allow to affect purposefully and differentiatedly different sides of the pathologic process, increasing the adaptive capabilities of the organism. Almost complete lack of side effects and low cost can be listed as their additional advantages, as well as the opportunity of combined appliance of pharmacotherapy [4, 20-23].

Including the preformed physical factors into the complex therapy of GU and DU has had an old history. However, their appliance for this disease is not always scientifically reasonable, which is probably explained with the imperfection of the demonstrative basis [1]. The success achieved for the past years in different scientific areas, as well as the technical progress as a whole have enlarged the horizons of the ideas and the understanding of a whole range of physical factors and this has given the opportunity to evaluate objectively the results of their use. Among the methods of the instrumental physiotherapy, along with the old ones, such as electrophoresis of medical drugs, diadynamic currants (DDC), alternating modulated current (AMC), ultrasound (US), alternating magnetic field (AMF), other approaches have created a good reputation: microwaves (MW), laser radiation, low-frequency ultrasound, ultra high-frequency therapy (UHFT), different puncture methods and other.

The variety of the opportunities of physiotherapy allows to affect both general and local mechanisms of ulcerogenesis.

The disbalance between the factors of aggression and protection, which appears at ulcer, is realised mostly at local level [24] and can be a comfortable target for a range of physiotherapeutical factors. According to modern ideas, acidopeptic factor, contamination of GMM and the focus of gastric metaplasia in DD HP, different versions of gastroduodenal dysmotility, as well as increased activity of the processes of lipid

peroxidation (LP), are included in the list of factors of aggression, causing autodigestion of a limited area of gastric MM (GMM) or DD with decreased resistance and ulcerogenesis. The range of factors of protection is represented by a firm mucous bicarbonate barrier, adequate blood supply and microcirculation in gastric paries and duodenal paries, a system of prostaglandins, local immune protection, physiological regeneration of epithelial cover of GMM, as well as the action of the duodenal lock mechanism of the gastric secretion [1, 25].

The priority of the affects directed against two listed aggressive factors – the acidopeptic and infectious ones, belongs to pharmacology. Physiotherapeutical methods have a big potential to affect other factors of aggression (gastroduodenal dysmotility, processes of LP), and particularly the factors of protection which can be regarded as a harmonic addition to traditional pharmacotherapy. The therapeutic effects of the majority of physical factors is conditioned by improvement of microcirculative processes and trophism of invaded tissues. There are evidences that the adequate regional blood supply defines optimal course of all energy-dependent processes in GMM and DD including the recover of gastric mucous bicarbonate barrier, as well as physiological and reparative regeneration of epithelial gland cells [1, 12, 25].

During the acute phase of ulcerous relapse (first 10-12 days), firstly the pain syndrome must be eliminated in epigastrium, which is a result of gastric and duodenal dyskinesia. The effect is achieved with low-frequency impulse physiotherapy (DDC and AMC), which have a signified analgesic effect and capability to normalise the impaired motility of the gastroduodenal area (GDA) [20, 21, 23]. However, DDC has a severe irritating effect on cutaneous receptors which limits the possibilities of this method. In acute phase of ulcerous relapse, the reduction of pain syndrome is achieved with the use of AMC which affects the epigastrium area, and if the disease has had a long history and a signified dyspeptic syndrome – the area of cervical sympathetical ganglions [26]. The method of combined treatment with AMC and ultrasound was recognized, which potentiates the spasmolytic and analgesic effect of both physiotherapeutic factors [20].

The efficiency of high-frequency ultrasound therapy (UST) at ulcer has been popular for long time, and is explained with its signified spasmolytic analgesic effect, normalization of the motor function and partly gastric secretory function, as well as stimulating processes of regeneration caused by improvement of cell respiration and regional blood flow [20, 23].

Recently, there has been information about high efficiency of low-frequency US therapy (22 and 44 Hz) at ulcerous relapse, which is probably explained with the ability to penetrate deeper into tissues, compared with high-frequency ultrasound [27]. There is also information that low frequency ultrasound has a much stronger analgesic effect than UHFT and magnetic laser therapy. It also has a normalizing effect on dysmotility of GDA which allows cicatrizing of ulcerous deficiency (UD) average for 17 days for 82% of the patients with gastric ulcerous localization and 93% of patients with duodenal ulcerous localization [27].

Among the physiotherapeutic factors having a signified stimulating effect on protective potency of GMM and DD, methods of MW therapy have been recognized, and mostly, methods of ultramicrowave therapy (UMW). Microwaves of the cm-band penetrate at local use into the depth of 5-7 centimetres, microwaves of dm-band (DMMW) penetrate a little deeper – 8-9 cm. This was the reason why they were used at ulcer. The specific effect of UMW radiation is explained by selective absorption of their energy by molecular structures of the cells, which is accompanied by creating of endogenic

warmth in tissues and activation of physical and chemical processes. As a result, vessels relax, pressure increases in microvasculature, vascular permeability decreases, metabolic processes and reparative regeneration processes improve [23]. This way, the effect of UMW radiation is realized simultaneously in different directions: the gastric mucous-bicarbonate barrier improves due to normalization of processes of mucogenesis (synthesis, accumulation, extrusion of neutral mucopolysaccharides); microcirculatory deficiency is eliminated due to stimulation of active mechanisms of microcirculation; inflammatory changes in the mucus membrane of the gastro-duodenal area reduce [20, 26, 28]. The method of MW is recommended mostly for hyperkinetic type of gastroduodenal dysmotility, which can be regarded as additional factor of aggression [1]. Some researchers notice that DMMW-therapy decreases the signified duodenogastric reflux. Without having specific antibacterial effect, UMW-radiation nevertheless decreases bacterial content of gastric and duodenal mucus membrane, and moderately potentiates the effect of anti-helicobacterial medicines. [22]. Having in mind the ability of the thyroid hormones to enforce regenerative processes in the organism and perform general trophic action, the effect is achieved by DMMW treatment in the area of the thyroid, mostly for ulcers with a big diameter and torpid course of the disease. Generally, UMW-therapy is recommended starting form subacute phase of ulcerous relapse, without complications [1, 26].

For complex therapy of gastric ulcer and duodenal ulcer, low-frequency alternating magnetic field is widely used, due to its analgesic and anti-inflammatory effect. [1, 29, 30]. A range of researchers notice in their works that monotherapy with alternating magnetic field (regardless of the medicines) causes cicatrisation of ulcerous deficiency for 60% of the patients. Combination of alternating magnetic field and ant-ulcerous pharmacotherapy (M-cholinolytics, H2- blockers of histamine receptors, antiacids) increases ulcerous cicatrisation ability up to 80-90%. A significant advantage of low-frequency alternating magnetic field is its ability to normalize impaired gastroduodenal motility. For example, there is information about reduced duodenogatric reflux for 85% of patients after a course of treatment with alternating magnetic field in pulsating mode. [31]

Due to its soft, gentle effect and factual lack of side effects, the alternating magnetic field can be recommended to be included to traditional pharmacotherapy of ulcer, regardless of the age, phase and the character of the disease, as well as during rehabilitation and for concomitant pathology [20, 22, 23].

Laser therapy became largely popular after fundamental discoveries in the area of quantum electronics and creating optical generators of a new type (lasers). Numerous modifications of laser radiation (helium-neon type laser, helium-cadmium, argon, on copper vapour, krypton etc) and a variety of treatment modes makes its use possible for all phases of ulcerous relapse. 4 methods of laser treatment are widely used: trans-endoscopic, intravascular, percutaneous and laser puncture. Each one of them has a specific mechanism of action and can be regarded as independent type of treatment [32, 33]. Trans-endoscopic laser treatment is realised mostly on a local level, causing anti-inflammatory effect, activating regional blood flow in the area of the ulcerous deficiency and stimulating regenerative and trophic processes, increasing cellular mitotic activity [34, 35]. Laser radiation eliminates focuses of local ischemia and improves oxygen consumption in the impaired tissues. Signified analgesic effect of trans-endoscopic laser therapy is explained with decrease of pathological impulsion from the ulcerous deficiency area. However, acting as a non-specific biostimulator of metabolic and reparative processes in impaired tissues, trans-endoscopic laser radiation of the ulcerous deficiency does not affect seriously general pathogenetic

mechanisms of ulcerogenesis [32]. Additionally, the technical complication of the procedure and the risk of gastric contamination with HP when using the endoscope, limit the opportunities of its use. Indications for trans-endoscopic laser therapy are newly found gastric ulcer and duodenal ulcer, signified and persistant pain syndrome, durably non-cicatrising ulcers, as well as ulcerous localisation in the area of pyloric sphincter. Comparative analysis has shown that trans-endoscopic laser therapy does not have significant advantages compared to transcutaneous laser therapy, whose efficiency is a result of rise of cutaneous-visceral reflex under laser impact on the dermal receptor instrument [38]. The range of indications for laser therapy is wide. Due to its signified analgesic effect, exceeding the effect of the most other physical factors, it can be applied on the first days of ulcerous relapse, at any stage of the disease. Additionally, laser radiation is a choice for elderly patients, especially in cases when gastric ulcer is combined with ischemic heart disease and diabetes mellitus, when problems of medical polypragmasy must be taken under consideration [37]. There is information about successful application of laser therapy at ulcer with complicated ulcerous penetration to adjacent organs. Indications for laser therapy on the background of traditional anti-ulcerous therapy are reasonable for patients with frequently relapsing and durably non-cicatrising gastric and duodenal ulcer. The frequency of relapses is decreased from 91,4% to 30,3% for one year [36]. The assertion that laser therapy can prevent ulcerous malignant changes still needs additional research [36].

Pathogenesis of ulcerogenesis cannot be explained only as an imbalance between factors of aggression and protection, interacting on local level. In 1994, Y.S. Zimmerman submitted an interesting conception of pathogenesis: ulcer is regarded as systemic gastroenterological disease, having genetic determinants; its development are mostly based on dysfunctions of adaptive regulative systems of the organism on different levels; HP-infection and acid peptic aggression play the part of important, but locally acting factors of pathogenesis. According to this conception, not only locally affecting factors of ulcerogenesis must be used for treatment, but also factors recovering impaired mechanisms of adaptive regulation and self-regulation on different levels [1, 4, 16, 18]. We must notice the fact that some of the physical factors are absolutely sufficient for this aim.

Methods of neurotropic physiotherapy: Electro-sleep, transcranial electro-analgesia were once widely used for complex treatment of patients with ulcer [20]. The interest in these methods was explained by significant changes of patients' functional condition of vegetative and central nervous systems, as well as dysfunction of cortico-subcortical intercourse. However, the large variability of individual sensitivity of the central cerebral formations to low-frequency currents limits the use of these methods of physiotherapy [20, 23].

When analyzing publications of the past few years, we can notice a significant interest in the search for new physiotherapeutic methods capable to repair impaired processes of regulation and self-regulation of the gastroduodenal system and integral controlling mechanisms of organism's visceral functions. Within the framework of the neurotropic stream of physiotherapy, the use of a type of electro-impulsive therapy of ulcer has been discussed – trans-cerebral interference therapy [39,40]. This method, selected as a monotherapy for patients with subacute phase of duodenal ulcerous relapse, proved to be more efficient compared with the traditional impact at the epigastric area, both as terms of reduction of pain and dyspeptic syndromes, and as effect on the dynamics of the inflammatory process. During the treatment after trans-cerebral methods, the quantity of somatotropin, thyreotropin, triiodothyronine, thyroxine and cortisol in the

blood is faster normalized, immune T-cellular part is stimulated, the level of auto-immune aggression is decreased, which leads to activation of trophic processes in gastroduodenal area and rapid cicatrisation of the ulcer (18 – 23 days after the beginning of the therapy, for 80% of the patients). Significant disadvantages of the interference-therapy are the fast habituation to interferential currents, which requires regular change of the frequency of "beats", and difficulties of forming interferential currents in limited surfaces.

The effect of weak electromagnetic fields with non-thermal rate also deserves attention as a factor of the course of ulcerous relapse. The density of the galvanic current induced by these electromagnetic fields into interfacial tissues is very small and seems to be unable to change significantly the functional characteristics of the excitable tissues, but the results of experimental and clinical researches have shown that this method can affect cortical and subcortical bioelectric processes and neurohemodynamics ("Infita" device). The biological effect of infitatherapy can be explained with the fact that probably, the electromagnetic fields of low intensity have resonance frequency, or amplitude-frequency "gaps" due to which the informational exchange with biological objects can be performed. The therapeutic effect is realized through hypothalamic-hypophysial system, acting as a soft liminal stimulator correcting cerebral bioelectric activity, metabolism of the central neuromediators and neurotransmitters, as well as calcium metabolism in the cerebral tissue [41]. The use of this method in complex therapy of ulcer proved to be effective. A range of frequencies, which are biotropic to the cerebral tissue (30- 57 Hz), stimulating cerebral activity and optimizing its tonus, was found [41]. The results of the researches evidence the fact that dysfunctions of cortico-subortical system of interaction and availability of cutaneous visceral connection, reflecting dysfunctions of adaptive regulation and self-regulation on different levels, take part in ulcerous pathogenesis.

Among the physiotherapeutic methods able to affect the processes of adaptation and to regulate mechanisms of sanogenesis, ultra high-frequency therapy (UHFT) takes a significant place [4, 30, 42, 43]. According to A. Presman's classification, this physiotherapeutic method refers to the informational methods, as the other methods have either energetic effect, or boundary effect (informational-energetic). The base of the therapeutic effect of UHF-radiations is the conformational alternation of the cutaneous structural elements, induced by electromagnetic radiations (EMR) of the mm-band and activation of nervous connections having tonic kinesis. Organism's reactions to mm-radio-waves develop within the framework of general adaptive syndrome and manifest as increase of organism's both specific and non-specific resistance to external factors [30]. The pioneers used EMR of mm-band in medical science and biology, are V.A. Nedzvetskiy and I.S. Cherkassov (1977), who obtained the first clinical results of UHF therapy of duodenal ulcer. The clinical effect of UHF monotherapy manifests as elimination of pain syndrome within 4 – 7 days, dyspeptic processes are eliminated within 7 – 12 days and ulcers cicatrize within 3 weeks for 75-88% of patients [4, 43, 44]. A specific characteristic of ulcerous cicatrizing during UHF-monotherapy is the marginal epithelization and lack of roughly formed conjunctive tissue cicatrix [44], as a higher cicatrisation speed is noticed mostly for duodenal ulcer, and less – for gastric ulcers. UHF-monotherapy stimulates organism's adaptive systems [45, 46]; repairs harmonic ratio between lipid peroxidation and the system of antioxidative protection [42, 46, 47], normalizes organism's immune status and rheological characteristics of the blood [45, 48], increases cytoprotective characteristics of mucus membrane in gastroduodenal area [49]. UHF electromagnetic radiations are less effective for gastric secretory and motility functions [42]. Combination of UHF and anti-ulcerous pharmacotherapy does not have significant advantages compared with

UHF monotherapy and in most cases it is regarded as improper [44]. Combination of UHF-therapy with anti-secretoty medicines is appropriate only for cases with signified hyperacidity, with ant-helicobacterial therapeutic schemes for massive HP-colonization of gastric and duodenal mucus membrane, because it potentiates the antibacterial effect [42, 49]. UHF-monotherapy can be used for any phase of ulcerous relapse; it is appropriate as prophylactics during the period of remission with even better effect than traditional pharmacotherapy: the number relapses decreases dramatically for 1-2 years after the course of UHF-therapy [4, 43, 50, 51]. It was not long ago when complicated ulcerous states were regarded as contraindication for UHF-therapy. However, numerous researchers notice that due to their immunomodulating and adaptogenic effect, mm-band of electromagnetic radiations can be included in the complex of therapeutic activities at early stages after surgical therapy of gastric and duodenal ulcer, as well as at complications with hemorrhage, penetration or perforation [45].

UHF-therapy using variable fringe of frequency generation signal in sweeping mode with individual selection of resonance frequency, is a method which is worth noticing [52]. MW-resonance therapy (bioinformational therapy) is also used, as one of its characteristics is the “swinging” frequency (from 52 to 62 GHz) and alternating wave bands, which allows an optimal frequency to be selected for each patient. Microwave resonance bioinformational therapy is recommended mostly for patients with bland course of duodenal ulcer. Microwave resonance bioinformational therapy is almost ineffective for most patients with complications and sthenic course of the disease, or with gastric localization of the ulcer [53]. Sometimes informational-undulatory therapy can be used, affecting with a set of resonance frequencies concentrated on one channel [54].

It is extremely hard to select precisely the resonance frequency of mm-band electromagnetic radiations. Nowadays, they define indirectly whether the correct frequency is selected, taking under consideration the positive clinical dynamics and the patient’s internal sensations. Search for objective criteria indicating the resonance effect seems to be promising, and it will allow the efficiency of UHF-therapy to be increased. First steps in this direction have already been made: it is suggested to evaluate biological system’s resonance with external UHF-field according to the neuromyographic kinesis with pseudoperiodic character, rising in biologically active areas [55].

Segmentary reflectory method or corporeal UHF-puncture on various biologically active points is traditionally used for UHF-treatment of gastric and duodenal ulcer [4, 42, 43, 46, 51].

Puncture methods of reflectory therapy of ulcer (laser puncture, magnetopuncture, UHF-puncture etc.) have been widely discussed in various publications over the past few years [32, 46, 51, 56, 57]. There is data about reflectory and humoral connection between corporeal biologically active points on the skin and certain visceral target-organs, the vegetative and central nervous system, as well as the hypothalamus, which plays important part in realization of reflectory effects at visceral dysfunctions. The list of advantages that these methods have is not limited by general effects, such as improving immune homeostasis, inhibiting processes of lipid peroxidation activities, general adaptive reactions, and normalization of psychological and vegetative status of the patients. The variety of biologically active points on the skin gives a unique opportunity to impact on impaired gastric motility and secretory functions, to stimulate metabolic and reparative processes in ulcerous area [1]. The specific effect of physical factors (laser puncture, electropuncture, UHF-puncture) on biologically active points is

still to be ascertained. Undoubtedly, the search for clear and scientifically based criteria of selection and optimal combination of biologically active points for treatment of ulcerous relapse will continue.

Development of combined therapeutic methods proved to be a promising direction of physiotherapeutic progress. The need of optimized parameters of complex therapeutic treatment explains scientists' interest in the problem of therapeutic interference, which is understood as interaction between different therapeutic agents, including physical factors [58, 59]. Potentiating ulcero-cicatrizing effect was noticed in combined use of UHF-therapy and laser puncture: ulcerous deficiencies cicatrize within 3 weeks for 97.8% of patients with ulcer. Combined acupuncture-reflexotherapy and transcutaneous laser therapy proved to be very effective for patients with duodenal ulcer refractory to pharmaceutical treatment [61]. Results of still rare researches give evidence of the good effect of magnetic-laser therapy on the course of ulcerous disease, shorter terms of ulcerous cicatrisation, and increased frequency of HP eradication. There is a hypothesis of possible decrease of relapses' frequency and extension of periods of remission on the background of polymagnetolaser therapy [61]. Potential capabilities of this method are still not completely explored; for example, in existing devices of magnetolaser therapy, the magnetic component is represented by a constant magnetic field, which is known to be less effective than other types of magnetic fields (for example, alternating magnetic field), in respect of biological activity [59]. The efficiency and appropriateness of other methods of combined physiotherapy of ulcer are to be explored.

For the past few years, some new technologies have appeared in therapeutic use of physical factors for ulcer, which increases therapeutic abilities of impact on impaired mechanisms of regulation and self-regulation on different levels.

First results of use of constant magnetic field of geomagnetic level for ulcerous relapses are comparable with the results of general magnetotherapy in respect of efficiency [62]. It is proved clinically and experimentally that weak magnetic fields have biological effect which realizes on all levels, starting from the cubcellular level. It was noticed that weak magnetic fields influence organism's reactivity, contribute to homeostatic regeneration, including immune regeneration, have general stimulating effect, potentiate the effect of numerous medicines and have anti-stress characteristics [30]. This therapeutic factor is noticed to have positive effect on microcirculation, inflammatory processes and activity of lipid peroxidation. The effect of the low-tension constant magnetic field on vital activity of various micro-organisms, including HP, and on their vulnerability to antibacterial therapy, is also interesting [62]. After a course of general geomagnetic therapy, performed on the background of traditional anti-ulcerous medicines, patients did not have ulcerous relapses for a period of 1 year [62]. This information needs to be verified.

A new and promising direction of physiotherapy, and particularly laser therapy, is development of methods of bio-controlled chronophysiotherapy, which opens opportunities of individually selected optimal portions of impact with the contribution of bio-controlled signals [63].

Recently, methods of bio-controlled low-frequency impulsive electrotherapy are used, particularly the effect of self-controlled energy-neuroadaptive regulator (SCENAR). The base of this method is impact on sensitive and neuromotor cutaneous connections with series of neuro-similar bipolar fluctuations of various frequency currents, which change depending on the strength of tissular capacitive reactance in the impacted area. As a

result, local changes in cutaneous microcirculation and cutaneous trophism appear due to local reactions (mechanism of axon-reflex) with formation of functional system and segmentary-reflectory reactions. Additionally, functionally transformed cortico-subcortical interaction is regenerated. The effective adapting reaction is achieved with the use of the principle of feedback [64, 65]. The dynamics of parameters of bio-controlled impact is defined by modification of the electric characteristics of patient's tissues. The use of impulses, similar to activity potentials of living excitable systems, gives the high efficiency of therapeutic procedures [66]. The list of therapeutic effects of SCENAR-therapy includes myoneurostimulating effect, local analgesic, trophic, and local vasoactive effect. Indications of use of SCENAR-type devices are various diseases which course includes impairing adaptive processes. Nowadays, SCENAR-therapy is successfully used for treatment of trophic ulcers, diseases of peripheral nervous system, neuroses, ischemic heart disease, inflammatory-dystrophic processes with different localization, vegetative dystonia etc. There are some works which evidence about possibility SCENAR-therapy to be applied for erosive-ulcerous areas of gastroduodenal area, including ulcer [67, 68].

Physiotherapy of patients with ulcer has a number of characteristics which should be particularly discussed. Previously, use of physical factors was regarded as undesirable for acute phases of ulcerous relapse, but nowadays, the wide range of physiotherapeutic methods enable their use in any phase of ulcerous relapse and during the periods of remission, and some of them can be used at complications. However, the postulate of personal approach when physical factors are selected remains as firm as before, and the stage, the phase of the disease's course, its severity, comorbidity and complications must be taken under consideration [1, 23]. Generally, the choice of physiotherapeutic method depends on the disease's stage, and in much less extent – on ulcerous localization.

In acute phase of relapse, alternating modulated current and diadynamic currents and ultrasound therapy are successfully used, taking under consideration the pain and dyspeptic syndrome which have to be quickly eliminated [26]. Methods of laser therapy, low-frequency alternating magnetic field and UHF-therapy proved to be universal in respect of their use in any phase of the disease. In subacute phase, various opportunities of physiotherapy enable the regulation of activating and inhibiting processes of central nervous system; enforce anti-inflammatory effect with the contribution of local and segmentary impact; have a good effect on gastric secretory and motility functions and stimulate processes of reparation.
The list of physiotherapeutic methods can be enlarged, adding to it MW-therapy, neurotropic therapy and puncture physiotherapy. For periods of remission, methods of balneotherapy and sanatorium therapy [20, 23]. The matter of physiotherapeutic impact on patients with different ulcerous localization, is also worth discussing.

Recognizing nosological unity of gastric ulcer and duodenal ulcer, majority of researchers agree that it is reasonable to distinguish at lest 2 clinical pathogenic forms of ulcer: pyloroduodenal and mediogastric. The reason of this approach lies in the significant differences of clinical pictures, the character of motor, evacuative and secretoty dysfunctions of gaster and duodenum, the character of vegetative and psycho-emotional dysfunctions, and some particular mechanisms of ulcerogenesis [1, 17]. A range of researches shows that pathogenetic importance of signified factors of aggression and protection of gastric mucus membrane is not the same for different ulcerous localizations. On local level, in case of pyloroduodenal ulcers, aggressive factors play an important part, but in case of mediogastric ulcers – weakening of protective mechanisms, and first of all – the whole mucous bicarbonate barrier, local

immune disbalance, microcirculatory deficiency, regenerative dysfunction etc. [39, 63, 69].

Differences between the two main clinical pathogenetic forms of ulcer also refer to functional condition of the main parts of vegetative nervous system. At pyloroduodenal ulcer, tonus of parasympathetic part of vegetative nervous system prevail, gastric motor activity increases, accelerated and arrhythmic evacuation of acidic gastric contents to duodenum is noticed [1]. At ulcer with mediogastric localization, sympathicotonia prevail; gastric tonus and motor activity are generally decreased, and evacuation is often retarded. Apart form this, deficiency of the closing function of pylorus is noticed, which creates conditions for duodenogastric reflux [1].

These clinical pathogenetic characteristics must be taken under consideration when prescribing different kinds of physiotherapy. It is a commonly known fact that anti-secretory medicines have much larger therapeutic effect on ulcers with duodenal localization than ulcers with gastric localization. Patients with duodenal ulcer are more sensitive to therapeutic factors with neuroregulatory effect [16]. Treatment of mediogastric ulcers is much more efficient when protective functions of gastric mucous membrane are enforced [12, 18, 69].

Undoubtedly, ulcerous localization must be taken under consideration when selecting physiotherapeutic methods. For duodenal ulcerous localization, it is appropriate to use physical factors having impact on integral mechanisms of adaptive regulation and self-regulation, controlling organism's visceral functions – UHF-therapy, methods of neurotropic physiotherapy, puncture methods of therapy (UHF, magnetopuncture, laser puncture). For mediagastric ulcers, it is more preferable to use methods having impact mostly on local factors of ulcerogenesis, reinforcing protective characteristics of gastric mucous system, and eliminating gastroduodenal dysmotility. For these cases, laser therapy, low-frequency magnetic field, low-frequency ultrasound, microwave therapy (ultra microwave), combined methods of treatment are recommended. This classification is conditional, and the choice of the physiotherapeutic factor should be personalized taking under consideration the clinical situation, the character of complications etc. There should be oncologic circumspection about ulcers with gastric localization for patients aged 40-50 and older, especially for refractory to treatment, big-sized ulcers.

Biorhytmologic approach proved to be effective as a physiotherapeutic procedure for patients with ulcer. A promising direction is the research of chronobiological mechanisms and optimization of parameters of physiotherapeutic effect [58].

To end up this review of publications, we should notice that the possibilities of physiotherapeutic treatment of patients with ulcer are far from being exhausted. A guarantee for achieving optimal effect from therapeutic activities is the combined use of physical factors and pharmaceutical therapy, which will have a harmonic effect on various pathogenetic mechanisms of ulcerogenesis.

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