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THE APPLICATION OF PHYSIOTHERAPEUTIC TREATMENT METHODS IN THE EARLY STAGES OF AVASCULAR OSTEONECROSIS OF THE FEMORAL HEAD

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Abstract

The incidence of avascular osteonecrosis of the femoral head has increased dramatically since the COVID-19 pandemic. The use of physiotherapeutic (restorative) methods of treatment in the complex of conservative treatment of the disease improves the quality of life of patients, eliminates pain and limitation of movement in the hip joint, and delays the need for surgical intervention as much as possible.

Keywords: osteonecrosis, rehabilitation, physiotherapy, magnetotherapy, extracorporeal pulsed wave therapy, laser therapy, therapeutic massage, exercise therapy, COVID-19.

Introduction

Relevance of the problem Avascular osteonecrosis of the femoral head is a multifactorial etiology, known as aseptic, atraumatic, avascular necrosis, or osteonecrosis, characterized by the development of deformation of a highly loaded area of the femoral head, impaired osteogenesis and resorption processes in the femur, a severe chronic degenerative-dystrophic disease. The basis of the development of the disease is a violation of blood circulation (ischemia) in the bone tissue.

As a result of the COVID-19 pandemic avascular osteonecrosis of the femoral head began in our republic in 2020 and has become one of the urgent problems of medicine today. The fact that the disease occurs mainly among middle-aged men and the increase in the number of patients is a clear confirmation of this. Throughout the world, the practice of joint arthroplasty (total arthroplasty) remains the main method of treating the disease. In the early stages of the disease, the use of physiotherapeutic procedures as part of complex treatment makes it possible to delay the surgical operation. It is impossible to carry out a full-fledged rehabilitation without rehabilitation means before and after the operation. The high efficiency of physiotherapeutic methods of treatment is often overlooked in medical practice. One of the important issues is



the search and implementation of evidence-based effective methods of treatment to prevent and reverse the progression of the disease without surgical intervention. The fact that almost all patients do not agree to surgery, the high cost of surgery, possible complications after the procedure, the presence in the scientific literature of conflicting opinions about the effectiveness of modern methods of surgery with preservation of the femoral head, indicate the importance of using physiotherapy methods in the complex treatment of early stages of the disease.

There are the following modern methods of treatment of avascular osteonecrosis of the femoral head:

1. **Physiotherapy** (hardware, physiotherapy exercises, massage);
2. **Conservative** (using pharmacological agents);
3. **Surgical** (bone grafting, core decompression, total arthroplasty).

PubMed, Cochrane Collaboration, Clinical Evidence, Best Evidence, Up to Date, Medscape MD Consult, Scopus, Web of Science, Springer Link sites were systematically analyzed and studied. According to the analysis of the data obtained, at present, all over the world, especially in European medical centers, 3 non-invasive physiotherapy methods are used in the early stages of aseptic osteonecrosis of the femoral head:

1. **Extracorporeal pulse wave therapy;**
2. **Low-frequency pulsed magnetotherapy.**

In addition, there is reliable information about the effectiveness of **low-intensity laser therapy, physiotherapy exercises** and **therapeutic massage** in the complex of physiotherapy treatment.

At all stages of the disease and regardless of the method of treatment, the main attention should be paid to the maximum reduction in the load on the hip joint, strict adherence to the orthopedic regimen.

The purpose of physiotherapy methods:

- increased blood circulation in the bone tissue;
- reduction of the ischemic process;
- vasodilatation (dilation of blood vessels);
- strengthening of local reparative and regenerative processes in the bone tissue;
- strengthening of angiogenesis and osteogenesis processes;
- elimination of inflammations;
- elimination of pain syndrome;
- reducing the load on the joint by increasing muscle tone and strength;
- hypocoagulative;
- stop the necrotic process.



Low intensity laser therapy

Mechanism of therapeutic action

The biological effect of laser therapy depends on the presence of primary photoreceptors (molecules capable of absorbing a quantum of light of a certain wavelength) in the affected tissue. Laser beams penetrate tissues to a depth of 5-7 cm.

- Laser beams accelerate the recovery process at the site of injury;
- Stimulates migration and proliferation of hematopoietic, mesenchymal and distant cells to the site of injury;
- Accelerates the restoration of bone tissue due to the proliferation of osteoblasts, increased synthesis of osteocalcin, accelerated bone mineralization, increased vascularization of bone tissue and the production of collagen fibers;
- synthesis of bone morphogenetic protein-osteoinductive growth factor;
- Improves lymph flow and lymphatic drainage by enhancing the contractile function of smooth muscle cells and lymphatic valves;
- Reduces tissue edema caused by venous thrombosis;
- Reduces ischemic cell damage;
- Blocks pain signals and has an analgesic effect.

Method of treatment and dosing regimen:

In medical practice, rays with a spectrum of red and infrared radiation are widely used. The diameter of the red light spot can be changed by moving it closer or further away from the body.

In avascular osteonecrosis of femoral head, laser beams are directed from the 3rd side of the hip joint. Treatment is carried out on open skin at a distance of 1 cm from the body, by remote method, persistent, permanent way. One point can be treated for up to 20 seconds, each area of the joint can be treated for up to 1-2 minutes, only 5-6 minutes. Treatment is carried out daily or every other day, the average course of treatment is 10-12 days. The course of laser treatment is recommended to repeat 2-3 times a year.

Contraindications

- Various formations on site action;
- Thyrotoxicosis;
- intolerance to individual laser radiation;
- Acute inflammatory process;
- Pregnancy;
- Not recommended in the stage of decompensation of diabetes mellitus.

Low-frequency pulsed magnetotherapy is a method of using various types of variable low-frequency electromagnetic fields for medicinal purposes.

The action of a magnetic field on the human body is based on the magnetomechanical effect on various biological systems and processes, as well as the electric field and current induction.

**Mechanism of therapeutic action:**

- Activates local blood circulation and microcirculation;
- Increases blood supply to the body and improves metabolism;
- It has a direct effect on the blood and its formed elements, on the absorption of plasma proteins. Many studies recognize that the content of heparin increases under the influence of a magnetic field;
- has a relaxing effect on the smooth muscles of peripheral vessels and dilates blood vessels;
- Reduces local pressure as a result of exposure to blood vessels and hematopoietic elements;
- Increases tissue nutrition by increasing vascular permeability, activating protein synthesis;
- Has an anti-inflammatory effect;
- Has an anti-inflammatory effect;
- Increases lymph flow;
- Has a mild analgesic effect.

Method of treatment and dosing regimen:

The technique of conducting low-frequency magnetotherapy depends on the magnetic apparatus, its technical characteristics and components. The contact method is mainly used. The inductors are located in the area of the hip joint. The procedure can be carried out without taking off your clothes, even over a plaster cast. The depth of tissue penetration depends on the magnetic inductor. In treatment

at a dose of 4-10 mTl (or 40-100 Hz) at a frequency of 30-60 Hz, the duration of treatment is up to 10-20 minutes. The course of treatment is up to 10-12 procedures daily or every other day. It is recommended to repeat the course of treatment with a magnetic field up to 2-3 times a year.

Contraindications:

- Hypotension;
- Acute circulatory disorders in the brain;
- Psychoses;
- Early postinfarction period;
- Implant a pacemaker;
- Bleeding or suspected bleeding;
- Individual intolerance.

Extracorporeal pulse-wave therapy (synonyms: extracorporeal, electromagnetic, remote pulse-wave therapy) is a method of therapeutic effect on bone and connective tissue using high-amplitude acoustic pulses.

Mechanism of therapeutic action

With an increase in the amplitude of sound pressure and the formation of a shock wave in biological tissues, the effect of absorbing the energy of the shock wave begins to manifest itself. Rayleigh and Stoneley surface transverse waves are formed at the border of tissues with



different acoustic resistance (soft tissue-bone), these waves are well absorbed in hard tissues and penetrate deep into the tissue. In solid tissue, under the action of a shock wave, the microstructural components of biological tissue are disturbed, this process is enhanced by water and its heating.

The processes caused by the shock wave in the tissues lead to the destruction of bone calcifications and the growth of connective tissue in the tendons and fascia. Stimulates metabolic processes, changes the permeability of cells in the area of depletion of the power of the pulse wave. EPTT reduces pain and reduces the process of damage in the femoral head. The disintegration and lysis of osteoblasts under the influence of macrophages leads to compression of the underlying nerve fibers and a decrease in pain sensitivity. This leads to the activation of reparative-regenerative processes in the necrotic femoral head. Experiments have shown that EZTT restores tissue oxygenation, reduces local edema, and stimulates angiogenesis. The main significance of EPTT in the complex treatment of SBAON is the stimulation of angiogenesis and osteogenesis. The level of evidence for the effectiveness of EPTT is IIA (level II of evidence for effectiveness - the evidence is based on the results of more than 1 planned experimental valid study; the level of recommendation is A - the presence of results based on reliable evidence).

Treatment Effects

- Osteolysis;
- Defibrotic;
- Hypoalgesic;
- Reparative-regenerative.

Contraindications

- Unclosed area of the growth zone in children;
- Rupture of muscles and tendons;
- Damage to the apparatus of the joint capsule;
- Deforming arthrosis;
- Pregnancy;
- Coagulopathy;
- Collagenosis;
- Chronic diseases of the nervous and cardiovascular systems.

Method of treatment and dosing regimen

For treatment, a pulse wave with a pressure of 2-3 bar and a frequency of 10-15 Hz is used. The depth of impact of such waves is 80 mm, and the effective area of impact is 20 mm. The pulse frequency is on average 5-10 pulses / sec. During one treatment, the total number of pulse frequencies reaches an average of 2000-2500. For the procedure, the patient lies on their side. The gel is applied to the area above the hip joint. The device head is fixed. The procedure is carried out daily or 1 time in 3-5 days, lasts 5-7 minutes, the course of treatment is 3-4



procedures. During the procedure, the patient may feel some pain and a local hematoma may appear.

Methods for assessing clinical effectiveness

1. Magnetic resonance imaging (MRI) is an X-ray method of examination, which is the most important examination method in the final diagnosis of the disease. Comparison of the changes revealed for the first time in dynamics allows to evaluate the effectiveness of treatment. The time of re-examination is carried out individually for each patient on the basis of the doctor's instructions, taking into account the patient's condition.

2. Harris scale - evaluation of the hip joint in 4 categories: pain, function, deformity, range of motion. Each category is given a specific score. The maximum score is 100. A score of 90-100 is considered good joint function, 80-89 is average, 70-79 is fair, and below 70 is poor.

3. Scales of pain:

- Visual analogue scale of pain (VAS);
- Digital pain scale with assessment;
- Verbal descriptive scale;
- Mimic scale.

4. Goniometry - determination of the maximum range of motion in the joints using a goniometer.

5. Densitometry - a method for determining bone density using ultrasound or X-ray examination.

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