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Etiopathogenesis and Modern Treatment of Aseptic Necrosis of the Femoral Head

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A B S T R A C T
Aseptic necrosis of a femoral head – severe chronic orthopedic pathology (1.2–12 %), diagnostics of which presents considerable difficulties. Problems of fast diagnostics, identical clinical symptoms, rapid development of the disease leads to disability. Risk group includes young and middle-aged men. The cause of the disease is unknown, the possibilities of conservative treatment are applied only in the early stages with doubtful efficiency, and among surgical none is the best. The research is performed in the traumatology center of Khabarovsk – clinical base of a Postgraduate Institute for Public Health Workers. During 2014–2019, retrospective analysis of treatment results was carried out on the basis of statistical data of 97 medical maps of patients diagnosed with aseptic necrosis of a femoral head, pathomorphological study of 49 preparations of the femoral head; laboratory analysis of immunological indicators of cellular immunity and thyroid hormones in the operated group of patients was carried out. Detected immunological changes indicate the systemic nature of the disease. Method of minimally invasive two-stage decompression of femoral neck is devel- oped. Minimum injury of the developed method of treatment provides undeniable advantages in contrast to previous methods of surgical treatment. The technique has been applied in 17 cases, with positive medium-term clinical results. Aseptic necrosis of a femoral head is a pathology with a polymorphologic picture, diagnosis of which presents considerable difficulties, associated with high risk of development at young age, is a current problem and demands further studying for the purpose of achievement of permanent long remission, and, perhaps, and an absolute recovery of the patient.

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JUSTIFICATION

Aseptic necrosis of the femoral head (ANGBC) is a severe chronic common pathology, the frequency of which, according to various authors, is 1.2–12% of all degenerative diseases of the musculoskeletal system [1]. The problem of early diagnosis and the absence of symptoms during the onset of the disease, the similarity of clinical signs with other pathological conditions and the rapid development of the disease lead to characteristic destructive processes. The results of changing the habitual rhythm of life and the lack of access to medical care due to the lack of effective treatment methods are persistent disability and disability [2].

The risk group in the development of this pathology is mainly the male population of working age. The main factors affecting the development of the process and aggravating its course: alcoholism, smoking, the use of corticosteroids, radiation. The risk factors of the disease should also include a number of serious diseases, such as sickle- cellular anemia; caisson disease, Gaucher disease, blood clotting disorders, coagulopathy, hyperlipidemia, vasculitis, chronic liver and kidney diseases requiring the use of aggressive

treatment methods such as hemodialysis, chemotherapy [3], as well as pregnancy.

The nature of the changes occurring in the femoral head has not been fully studied, but the traumatic etiology of the disease remains unquestionable. According to S. Delaunay, depending on the severity of the injury, 10-50% of patients with various injuries of the hip joint (TBS) develop aseptic necrosis in the near or long term [4]. A number of foreign authors [5, 6], having studied modern methods of surgical treatment for fractures and their long-term consequences, believe that the development of ANGBC is influenced by the age of the patient and the postponement of surgery, but not the method of treatment [7].

Along with these conclusions, there are non-traumatic or avascular theories of origin associated with insufficient blood supply [8], increased intraosseous pressure, functional inferiority of TBS, toxic effects of drugs [9, 10], metabolic [11], neurogenic disorders.

The study of the pathogenesis of the disease over the past century has not yielded fruitful results of the same type, defining this problem, from the point of view of many specialists, as unsolvable. For example, M.G. Prives (1938) determined that the arteries of the femoral head do not end blindly, suggesting the possibility of a thromboembolic mechanism. V.P. Graziansky (1955) believed that ANGBC is a secondary pathology. The possible involvement of the parasympathetic nervous system in the development of the pathological process was expressed by A.L. Himmelfarb, who claimed that pathological impulses from the focus contribute to the development of reflex vasospasm, disrupting blood supply. Focusing on the presence of vascular disorders, a number of researchers (Solomon L., Moroz N.F.) considered the arterial, venous and mixed components separately, referring to the need to revise the ischemic theory of pathogenesis [12]. Over the past 13 years, thanks to a variety of foreign experimental models, the number of assumptions about the pathogenesis of the disease has increased significantly. The changes occurring in the femoral head are primarily caused by a local violation of blood flow [13], which leads to the development of ischemic phenomena. As a result, there is a violation of tissue metabolism, increased osteoclastic resorption, thinning and sponging of compact matter, an increase in bone marrow spaces and the development of necrosis.

Lipid disorders, including as a result of increased steroid levels, play an important role in the nutrition of the joint and, most likely, are one of the causes of vascular disorders [14]. The study of genetic aspects of pathology has shown the important role of oxidative damage to the DNA of hematopoietic bone marrow cells [15], polymorphism of various genes and endothelial synthase [16, 17].

Proponents of molecular research come to the conclusion that there is a causal relationship with the synthesis of osteoprotegerin [18], factors fibroblast growth [19, 20], the level of leptin in the bone marrow and the loss of proteoglycan, comparing them with inflammatory changes in arthritis and considering that ANGBC may be preceded by an inflammatory reaction [21, 22].

Classifications of this disease are practically absent and are mainly represented by the X-ray picture and symptoms, not counting the form of the process. There are 4 types of ANGBC: peripheral, with a lesion of the external part of the head; central; segmental, in the form of a small area of necrosis in the upper or upper part; complete lesion. The expansion of the possibilities of radiation diagnostics in recent years has made it possible to make a significant step forward in the examination of patients at the early stages of ANGBC development. The sensitivity and specificity of magnetic resonance imaging (MRI) [23] in the differential diagnosis of this disease is 98%, allowing to identify the pathological process at the initial stage (I art.) [24], at the II stage of the disease, computed tomography is used, at the III-IV stages - radiographic methods, according to international According to the ARCO, Ficat and Arlet classifications, V. Packialakshmi, conducting a number of experimental studies, identified a number of low-molecular-weight proteins specific to ANGBC, and Z.N. Ghale-Noie, in experiments on rats, it was possible to detect alpha-2-macroglobulin, which changes its parameters during the development of femoral head necrosis [25, 26]. The effectiveness of conservative treatment depends primarily on the localization and severity of the process, as well as on the age and general health of the patient, the outcome of which correlates with the stage of the disease and should be a comprehensive approach. Conservative therapy traditionally includes: compliance with the optimal orthopedic regime, therapeutic gymnastics, medical and physical therapy. Pharmacotherapy methods include the use of biphosphonates, low molecular weight heparins [27, 28], ossein-hydroxyapatite complex, vasodilators, antiplatelet agents, calcium and vitamin D preparations using intra-articular administration of dimexide, chondroitin, perfluorane, hydrogen-enriched saline solution, platelet-enriched

plasma [29, 30]. J. Pak, isolating stem cells cells from adipose tissue and using platelet-rich plasma together with hyaluronic acid, reports a complete recovery of the patient at the first stage of necrosis of the femoral head. Despite the many proposed methods, treatment of ANGBC is possible only at the early stages of the disease, in which, as a rule, standard research methods do not provide opportunities to recognize

the pathological condition in a timely manner. Existing surgical methods are used with different frequency, while none of the methods can be called the best. Classical variants of surgical treatment, such as tunneling, have been repeatedly revised and are used together with transplantation of mesenchymal bone marrow cells, recombinant human bone morphogenetic proteins, tunnel replacement with an autograft of the ilium [31], fibula, vascularized graft on a nutrient pedicle [32], a porous tantalum rod. Methods of multiple tunneling have been developed for the purpose of maximum revascularization of the femoral head.

Various corrective osteotomies offered recently, by changing the point of maximum load on the femoral head, they do not allow to restore the configuration of the articular surface with a far-reaching destructive process and create technical difficulties for subsequent endoproteinization. The above methods, used separately, give only insignificant dynamics, allowing to postpone radical surgery for a short time.

In the modern literature, data on the positive results of arthroscopic methods of treatment of ANGBC in the early stages [33] with the use of arthroscopic curettage of the necrotic area with the introduction of autogenous bone cylinders have recently become increasingly common. Endoscopic navigation, which makes it possible to assess in detail the accuracy and effectiveness of surgical manipulations, is compared in its effectiveness only with decompression methods of treatment. Over the past three years, there have been increasingly frequent reports in favor of minimally invasive surgery in the treatment of this disease, namely: on the effectiveness of bone grafting using arthroscopic control [34], the results of the use of multiple tunneling in combination with hip arthroscopy [35]. N. Zhuo, analyzed modern approaches to surgical treatment, came to the conclusion that arthroscopic decompression with bone grafting with a spongy autograft has many positive advantages.

Total hip replacement is currently the main method of modern treatment, widespread throughout the world, which, in turn, at stages III–IV of the disease gives relatively good medium-term clinical results. However, there is an opinion on the need to limit the indications for the use of the method due to the high risk of revision interventions. According to the data of foreign arthroplasty registries, the ten-year survival rate of total endoprostheses in twenty-year-old patients is up to 70%, and in patients younger than 50 years, up to 63% of artificial joints undergo revision after 19 years.

Effective prevention of aseptic necrosis of the femoral head is a difficult task, including early medical examination of risk groups, strict sequence of patient supervision with the earliest possible diagnosis of the corresponding stage of the process, compliance with the complexity of rehabilitation measures [36], and information about this is practically not found in modern literature.

The aim of the study is to develop modern effective technologies for the early diagnosis and treatment of aseptic necrosis of the femoral head in adults (based on the study of risk factors and causes of the disease, the presence of endocrine and immunological changes in hematological indicators in this disease, pathomorphological features, improvement of existing surgical methods of treatment, analysis of the results of surgical treatment).

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