

# Clinical and Pathomorphological Changes of Idiopathic Coxarthrosis in Patients with COVID-19

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**Abstract** In this scientific study, the morphogenesis and specific pathomorphological changes of aseptic necrosis of idiopathic coxarthrosis developed in patients infected with COVID-19 were studied. As an object, surgery was performed on 11 patients, and the area of the femoral head with aseptic necrosis, the external membrane of the bone, and the proximal part of the femur were removed. In the initial period of aseptic necrosis of the femur, it was found that necrobiotic changes developed due to the narrowing and thrombosis of blood vessels in the outer membrane and soft tissues around the bone. Necrobiotic changes were found as a result of necrobiosis of interstitial osteoid material in the femur head and neck bone, resulting in the formation of spaces with destroyed osteoblasts, osteoclasts, and fibroblasts, and then the development of dystrophic and destructive changes in the solid pillars of the bone. During the III period of the process of aseptic necrosis, sequestrations from solid bone columns, and structureless dendrites from intermediate osteoid structures were observed.

**Keywords** Idiopathic coxarthrosis, COVID-19, Femoral head, Degenerative, Aseptic necrosis, Morphogenesis, Pathomorphology

## 1. Introduction

In 2019, the world was covered by the coronavirus infection caused by SARS-CoV-2. From the first day, international medical teams began to study the acute phase of this infection, but later it became clear that the presence of delayed consequences of a multisystem character, manifested in various forms, was confirmed. In the autumn of 2021, at the suggestion of the World Health Organization, the name "post-covid syndrome", risk factors, pathogenesis and clinical-morphological course were discussed. Since the post-covid syndrome has a multisystem character, it was determined that necrotic-degenerative diseases develop as a result of aseptic necrosis of bones, including aseptic necrosis of the femur [1,2]. In addition, multiple comorbidities have been observed to aggravate the course of SARS-CoV-2, often resulting in death. It was confirmed that arterial hypertension - 55.4%, diabetes - 17.5%, obesity - 35.5%, CKD - 21.6%, and degenerative diseases of the femoral head - 18.4% were diagnosed among people over 60 years of age. Several factors are important in the development of post-covid syndrome; state of immune deficiency, preservation of residual damage, exacerbation of concomitant diseases, reactivation of the virus, catabolic

syndrome, persistent viremia, relapse of infection, endothelial dysfunction, vascular thrombosis [3,4,5]. Osteonecrosis disease, which has polyetiological causes, including damage to bone marrow and bone columns observed in the post-covid syndrome, occurs in 20,000 people around the world every year [1,4]. It should be noted that foci of aseptic necrosis can be detected in several bones in one patient, of which 13% of cases occur in the femoral head and ankle. In idiopathic coxarthrosis complicated aseptic necrosis, the death of osteocytes and bone marrow cells occurs as a result of bone infarction, the reason for which is the lack of collateral vessels in the arteries that supply blood to the bone and the development of thrombosis due to COVID-19.

Due to the lack of information in the scientific literature about the morphogenesis and pathogistological changes of aseptic necrosis of the pelvic bone tissue due to COVID-19, the study of its development pathogenesis, morphogenesis and pathogistological changes of the aseptic necrosis developed in the bone tissue is an urgent problem. Taking into account these discussions, the scientific research aimed to determine the morphogenesis and characteristic pathomorphological changes of aseptic necrosis of the femoral head developed in patients infected with COVID-19.

## 2. Material and Methods

As a material, the clinical-anamnestic and surgical tissue

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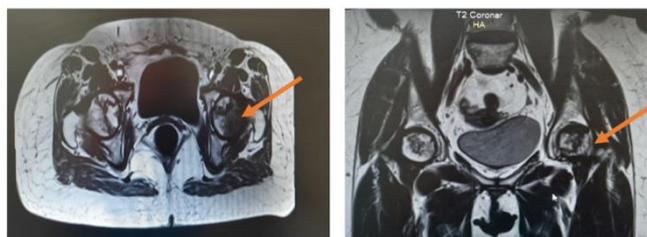
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materials of 19 patients who underwent treatment with dystrophic-degenerative diseases of the femoral head in the orthopaedic department of the Andijan Regional Orthopedic and Traumatology Hospital during 2019-2022 were studied. The age of the patients ranged from 25 to 60 years, with an average age of 42.6 years. In 19 patients, various degrees of aseptic necrosis of the femoral head were detected, and in 11 of them, surgery was performed, the area of the femoral head affected by aseptic necrosis, the outer membrane of the bone, the membrane of the femur, and the neck of the femur were removed together. Tissue pieces were examined macroscopically, and 1.5-1.5 cm pieces were cut from each and frozen in 10% formalin with phosphate buffer solution for 72 hours. The bony part of the slices was decalcified in 10% nitric acid. Then, after washing in running water for 3-4 hours, they were dehydrated in alcohols of increasing concentration, paraffin with wax added, and bricks were prepared. Histological sections of 5-7  $\mu$ m were taken from paraffin blocks, deparaffinized, and stained with hematoxylin and eosin. Histological preparations were studied under a light microscope, and pictures were taken from the necessary places.

### 3. Results and Discussion

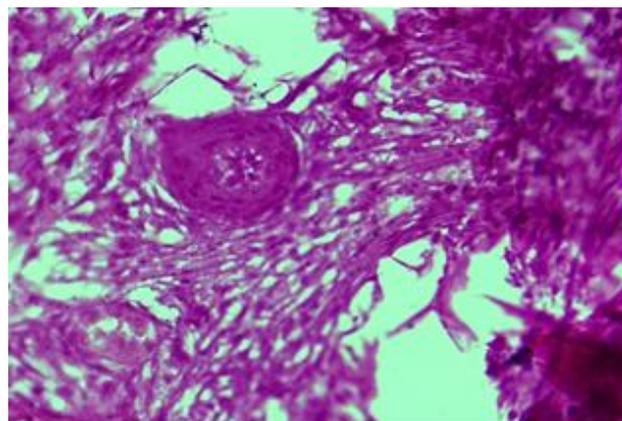
According to the results of X-ray and MRI examinations conducted in patients with the post-covid syndrome of aseptic necrosis complicated by idiopathic coxarthrosis, the focus of aseptic necrosis in the area of the femoral head with the presence of necrosis foci in the form of magnetic resonance signals of different degrees, sickle-shaped lines around these foci in T1-VI coronal projection of different degrees. It is determined by the appearance of magnetic resonance signals and two lines on T2-VI coronal projection, one with inner high intensity and the other with outer low intensity (see Fig. 1).



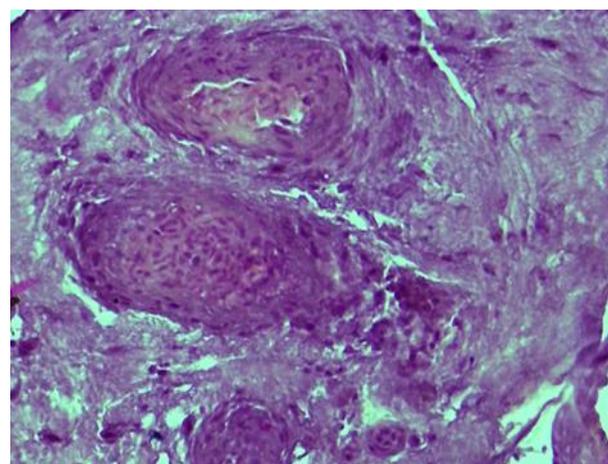
**Figure 1.** Aseptic necrosis of the femoral head in idiopathic coxarthrosis caused by COVID-19, low on T1-VI projection, and high on T2-VI projection MRI signals

In this case, it was found that depending on the degree of necrosis of the bone tissue, MRI signals were manifested at different levels. It was observed that if blood was poured into the necrosis site, the MRI signals had a high intensity in both projections, if the necrosis site was soaked with tissue fluid, the MRI signals were low, and even if fibrosis and osteosclerosis developed, the MRI signals were of low intensity. According to the results of the morphological examination, in the first period of the process of aseptic

necrosis, the soft tissues around the proximal femoral bones and the tissue in the bone membrane were severely swollen, the cellular and fibrous structures were shrivelled and disorganized, and vacuolated spaces appeared in the interstitium. Attention-grabbing morphological changes are observed in blood vessels in these tissues. It is determined that the wall of arterial vessels is thickened due to swelling and expansion due to dystrophy and disorganization of cellular and fibrous structures (see Fig. 2). Endothelial cells on the inner surface are also enlarged in size, and it is observed that they take place in the cavity with a bulging appearance. On the contrary, it is found that the venous vessels are widened, the wall is thinned, and plasma proteins and blood cells are concentrated inside.



**Figure 2.** The outer membrane of the bone and the surrounding soft tissue is swollen and inflamed, the wall of the artery is thickened, the cavity is narrowed, the vein is widened and the wall is thinned. Paint: G-E. Floor: 10x40



**Figure 3.** The proliferation of blood vessel wall cells in the periosteum, narrowing of the cavity. Paint: G-E. Floor: 10x40

In the second period of aseptic necrosis of the femoral head, it is determined that the outer membrane of the bone has turned into a structureless structure due to the necrosis of tissue structures. In this case, cellular structures are not detected in the soft tissue, and as a result of their disintegration and death, it is observed that inclusions stained with dark blue colour with hematoxylin appeared. However, it is determined that the blood vessels in this soft

tissue at the level of the necrotic process are relatively intact. Endothelial, pericyte and smooth muscle cells in the wall of blood vessels are found to have formed a dense cell infiltrate in the vessel wall as a result of strong compensatory proliferation (see Fig. 3). As a result, it is observed that the space of the arteries is narrowed and blocked, and in some of them, a cellular thrombus has appeared.

In the initial period of aseptic necrosis of the femoral head, discirculatory, dystrophic, and necrobiotic processes are developed in the bone structure. The external hyaline membrane of the femoral head is slightly thicker than usual, the connective tissue cells in it increase in size due to the processes of dystrophy and disorganization in response to the ischemia process, the staining with hematoxylin increases and become scattered dark ink is detected. Due to mesenchymal dystrophy of the fibre structures of the retina, it is observed that the state of staining has changed and the size has expanded. In the structure of the peripheral dense columns of the bone, it is determined that the necrobiotic processes cause the swelling and thickening of the osteoid material, and the fibrous structures are hyperchromic and disorganized. It is observed that the osteocytes in the columns undergo dystrophy, the nucleus becomes round and small, and the cytoplasm is swollen and vacuolated. Internal bone columns are of different thicknesses, and most of them are deformed, it is determined that the osteocyte cells in the content are dystrophies and swollen, so they look like chondrocytes. It is determined that vacuolated spaces of various sizes have appeared in the inner middle parts of the femur due to necrosis and swelling of the osteoid substance. In some of the cavities, it is determined that osteoblast, osteoclast and fibroblast cells, which have undergone necrobiosis to different degrees, are located.

In some cases of aseptic necrosis of the femoral head, when blood is injected into the necrosing bone tissue, it was shown that magnetic resonance signals have a high intensity in both projections of the MRI examination, and if the necrosis centre is soaked with tissue fluid and plasma, the MRI signals are shown at a low-intensity level.

During the III period of aseptic necrosis developed in femur bones, that is, during the period of the appearance of foci of aseptic necrosis, this condition is observed, and it is determined that the solid and dense columns of bone tissue are broken and fragmented as a result of necrobiotic changes, sequestrations of various sizes are formed. death of osteocyte cells, severe calcinosis is observed in the peripheral part of fragments. It is determined that the main substance of the bone between the sequestration fragments is completely necrotic and has entered a structureless state. It is also found that swelling foci and calcinosis have developed.

#### 4. Conclusions

In idiopathic coxarthrosis, the focus of aseptic necrosis in the head of the femur shows signals of different intensities in the MRT examination, if there is blood, the intensity of the

signals increases, if the tissue fluid is absorbed, and if osteosclerosis develops, a decrease is observed. Necrobiotic changes develop as a result of narrowing and thrombosis of blood vessels in the tissues. Initially, the interstitial osteoid substance becomes necrobiosis in the femoral head, creating spaces where destroyed osteoblasts, osteoclasts and fibroblasts are located, then necrobiotic changes occur due to the development of dystrophic and destructive changes in the solid columns of the bone. The process of aseptic necrosis During the III period, during the formation of foci of true necrosis, sequestrations from solid bone pillars, and structureless dendrites from intermediate osteoid structures are determined. In conclusion, it can be said that the full diagnosis of diseases leads to the improvement of the effectiveness of treatment, which is a task performed for the social, and economic development and prosperity of our people.

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