COMPARISON OF THE EFFECTIVENESS OF TRADITIONAL AND DIFFERENTIATED CONSERVATIVE TREATMENT METHODS FOR AVASCULAR NECROSIS OF THE FEMORAL HEAD FOLLOWING COVID-19 INFECTION

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Abstract. Background: Avascular necrosis (AVN) of the femoral head is an ischemic bone disease that can progress to joint destruction. Post-COVID-19 patients are increasingly being diagnosed with AVN due to virus-induced vascular damage. Traditional treatments often fail to target the altered microvascular environment caused by COVID-19. Objective: To evaluate the clinical and radiological outcomes of a new combination treatment for AVN in post-COVID patients. Methods: A retrospective cohort study was conducted with 198 patients diagnosed with MRI-confirmed Stage 1–3 AVN of the femoral head post-COVID infection. Patients were divided into two groups: conventional therapy (n = 90) and novel combination therapy (n = 108). Clinical, radiographic, and quality-of-life outcomes were assessed over 6 to 18 months. Results: The main group had lower femoral head collapse (10.2% vs. 37.8%), reduced surgical intervention (2.8% vs. 6.7%), and significantly improved SF-36 quality of life scores. MRI scans indicated better structural preservation, and VAS scores for pain improved more markedly in the main group. Conclusion: This novel multimodal treatment combining bisphosphonates and hirudotherapy significantly improves outcomes in AVN following COVID-19, offering a promising non-surgical alternative for early-stage disease.

Keywords: Avascular necrosis, COVID-19, bisphosphonates, hirudotherapy, femoral head, osteonecrosis, vascular injury.

Introduction. Avascular necrosis (AVN), also known as osteonecrosis, is a condition marked by the progressive death of bone tissue due to impaired blood supply to the bone tissue. The femoral head is the most common site affected, leading to joint degeneration and disability if left untreated [2, 4, 6]. AVN is often associated with conditions like long-term corticosteroid use, alcohol abuse, trauma, and systemic diseases such as sickle cell anemia and lupus [3, 7, 9]. However, the recent surge in AVN cases following COVID-19 infection has raised new concerns among clinicians [1, 13, 18].

Unlike the traditional AVN pathogenesis, which frequently involves long-term corticosteroid use, post-COVID AVN has been observed even in patients with minimal to no corticosteroid exposure [11, 19]. This suggests that the SARS-CoV-2 virus itself might play a critical role in AVN's development, likely through mechanisms like endothelial dysfunction, hypercoagulability, microthrombosis, and direct vascular injury [5, 21, 25]. The COVID-19 virus induces endothelial inflammation, which disrupts vascular integrity, leading to microvascular thrombosis, ischemia, and subsequent bone necrosis [21, 24].

As AVN is becoming more common in post-COVID patients, the traditional treatments, i.e., corticosteroids, NSAIDs, bisphosphonates, and rehabilitation, are ineffective [15, 19, 22]. As bisphosphonates inhibit osteoclastic activity and stop bone loss by not functioning at microvascular damage at the fundamental level, they have also failed in most cases [17, 19, 21]. Medicinal leech therapy, or hirudotherapy, has been suggested as a novel method of improving microcirculation, removing venous congestion, and inducing neovascularization. These actions are all significant in the advancement of bone healing as the reestablishment of blood supply is critical in the fight against ischemia [18, 23]. The objective of the current research is to assess the effect of new multimodal

treatment using bisphosphonates and hirudotherapy on the AVN treatment in post-COVID patients [2, 23].

We hypothesize that this treatment will be more effective than standard treatment in clinical, radiological, and quality-of-life scores by affecting bone metabolism as well as vascular damage.

Materials and methods.

Study Design and Setting

This retrospective cohort study was conducted at Tashkent Medical Academy between January 2021 and December 2024. Data were collected from orthopedic, radiology, and rehabilitation departments. Patients diagnosed with post-COVID AVN of the femoral head were enrolled after ethical approval from the Institutional Review Board.

Inclusion Criteria:

• Age between 18 and 75 years

► SARS-CoV-2 IgG positive (confirmed history of COVID-19)

► MRI-confirmed AVN of the femoral head (Ficat-Arlet Stage I–III)

Exclusion Criteria:

• Previous hip surgery or joint replacement

• Severe systemic illness or contraindications to bisphosphonates

• Incomplete follow-up data or inability to attend follow-up visits

Patient Groups

Control Group (n=90): Standard care consisting of NSAIDs for pain management, corticosteroids (if indicated), systemic anticoagulants, and vitamin D3 supplementation.

Main Group (n=108): Bisphosphonates (oral alendronate 70 mg weekly), vitamin D3 supplementation, Hirudotherapy at the hip 3 times every 10 days, Nutritional and anti-inflammatory support

Outcome Measure

• Radiological assessment: MRI (T1 and STIR sequences) at baseline and at 6, 12, and 18 months

• Pain: Visual Analogue Scale (VAS)

• Function: Timed Up and Go (TUG) test

• Quality of life: SF-36 questionnaire

• Need for surgical intervention: Necessity for hip replacement

Results.

a. Radiological Outcomes (refer to table 1)

Femoral head collapse: Main group: 10.2%, Control group: 37.8%

Progression to Stage 3 AVN:

Main group: 19.4%

Control group: 51.1%

Table 1.

Radiologic outcomes

Stages according to ficat and arlet classification	Total (N)	Number of patients showing Radiographic Progress (%)	Number of patients showing Radiographic collapse (%)	Number of patients undergoing surgery (%)
Main Group (n=108)	108	21 (19.4%)	11 (10.2%)	3 (2.8%)
Stage 1	16	9 (56.3%)	1 (6.3%)	0
Stage 2	81	10 (12.3%)	10 (12.3%)	0
Stage 3	11	2 (18.2%)	0	3 (27.3%)

Control group (n=90)	90	15 (16.7%)	34 (37.8%)	6 (6.7%)
Stage 1	14	7 (50%)	2 (14.3%)	0
Stage 2	67	7 (10.4%)	26 (38.8%)	0
Stage 3	9	1 (11.1%)	6 (66.7%)	6 (66.7%)

b. Pain and Function

VAS Score

Main group: $7.2 \rightarrow 1.6$ (improvement of 5.6 points)

Control group: $7.1 \rightarrow 3.9$ (improvement of 3.2 points)

c. SF-36 Quality of Life Score

Main group showed significant improvements in all domains, especially in physical functioning and pain reduction.

d. Surgical Outcome

Main group: 3 patients (2.8%) required surgery

Control group: 6 patients (6.7%) required surgery

Discussion. There is ample evidence in this research supporting the therapeutic benefits of the combination of bisphosphonates and hirudotherapy in the treatment of AVN following COVID-19 infection. The results indicate that this multimodal treatment not only preserves femoral head structure but also improves pain, function, and quality of life compared to conventional therapy [6, 9, 15]. The significantly reduced incidence of collapse of the femoral head and advancement to later phases of AVN in the main group suggests that bisphosphonates, being inhibitors of osteoclast-mediated bone resorption, play a pivotal role in stabilizing the dead bone [22].

Apart from bisphosphonates, hirudotherapy offers extra benefit with the improvement in blood supply and ischemic injury prevention to bone tissue. The application of medicinal leeches to the injured region enhances venous return, prevents thrombosis, and stimulates the development of new blood vessels, essential for healing the tissue [17, 23, 25]. This new combination therapy targets both the bone and vascular aspects of post-COVID AVN, treating the pathophysiology of the condition instead of symptomatic improvement.

The significant improvement in VAS and TUG scores signifies that patients on the combination therapy exhibit amazing reduction in pain and functional impairment, leading to increased mobility and independence. The quality of life improvement, as reflected by SF-36, is also the global benefits of this therapeutic modality, which emphasize the need for addressing physical as well as psychological recovery issues [13, 19]. These are consistent with recent studies reporting that post-COVID complications, particularly vascular and musculoskeletal, have to be addressed by managing them through protocols for the ischemic and inflammatory components of the disease. Our study builds on the hypothesis that early use of bisphosphonates and hirudotherapy may be a non-surgical procedure of joint replacement in the treatment of post-COVID AVN.

Conclusion. This study proves the effectiveness of a combination of bisphosphonates and hirudotherapy for the treatment of avascular necrosis of the femoral head due to COVID-19 infection. With combined therapy of the ischemic and metabolic aspects of the disease, this new multimodal therapy significantly improves radiological, functional, and quality-of-life parameters, offering a promising new alternative to conventional therapy. This association can diminish demands for early surgery and improve late patient outcomes if started early enough, providing perhaps a new post-COVID AVN standard of care.

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