

Case Report

An integrative orthobiologic approach to femoral head osteonecrosis: a case report

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ABSTRACT

Avascular necrosis (AVN), is a progressive disorder resulting from impaired blood supply to the femoral head leading to subchondral collapse and secondary osteoarthritis. Augmentation with percutaneous core decompression (PCD) with Hyperbaric oxygen therapy (HBOT) and curcumin/95 supplementation with structured rehabilitation would demonstrate benefits in AVN. 37-year-old man presented with eight-month history of right hip pain with difficulties (walking, squatting, stair and gait). MRI imaging confirmed AVN of right femoral head stage II B (Ficat-Arlet) and baseline patient presented Visual Analog Scale (VAS) 6/10, Oxford Hip Score (OHS)/33 with reduced muscle strength. The patient underwent PCD with bone marrow aspirate concentrate (BMAC) and high platelet-rich-plasma (PRP) followed by 15 sessions of HBOT, with strengthening of hip core and gait, with curcumin/95, 1000 mg daily for 60 days. At six months, the patient showed decrease in VAS score from 6/10 to 1/10, Oxford Hip Score increased from 33 to 43, Right hip flexion improved from 100° to 125° with mild pain, internal rotation from 10° to 30°, and extension from 15° to 20°. Hip muscle strength improved from grades 3-4/5 at baseline to 5/5 across assessed muscle groups. The antalgic gait and localized tenderness resolved, and functional mobility improved. This study advocates multimodal treatment strategy to arrive at functional status noted at six months with improvement in pain, hip mobility, muscle strength and gait. However, the contribution of individual treatment components cannot be determined from a single case, and longer-term controlled studies are required.

Keywords: Avascular necrosis, Femoral head, Bone marrow concentrate, Platelet-rich plasma, Percutaneous core decompression, Hyperbaric oxygen therapy

INTRODUCTION

Avascular necrosis (AVN), also referred to as osteonecrosis of the femoral head (ONFH), is a progressive musculoskeletal disorder caused by disruption of the blood supply to the femoral head, resulting in ischemia, osteocyte death, subchondral bone collapse, and ultimately secondary osteoarthritis.^{1,2} The disease predominantly affects young and middle-aged

adults and is associated with significant pain, impaired mobility, and reduced quality of life.^{1,3} Common risk factors include prolonged corticosteroid use, excessive alcohol consumption, trauma, hematological disorders, autoimmune diseases, and metabolic abnormalities, with considerable proportion of patients have no identifiable cause.² The management of AVN is largely determined by disease stage. In the precollapse stages (Ficat-Arlet Stages I and II or Association Research Circulation

Osseous Stages I–II), joint-preserving procedures are preferred to delay or prevent femoral head collapse and postpone the need for total hip arthroplasty (THA).^{3,4} Core decompression remains one of the most commonly performed surgical interventions because it decreases intraosseous pressure, improve vascular perfusion, and alleviates pain. Nevertheless, the efficacy of core decompression alone remains variable, particularly in patients with larger necrotic lesions, prompting the development of biological augmentation strategies.^{3,5}

Bone marrow aspirate concentrate (BMAC) has emerged as a promising orthobiologic therapy because it contains mesenchymal stromal cells, hematopoietic progenitor, endothelial progenitor, and several growth factors that promote angiogenesis, osteogenesis, immunomodulation, and tissue regeneration.^{5,6} Recent systematic reviews and meta-analyses have demonstrated that combining BMAC or stem cell therapy with core decompression significantly improves hip function, reduces disease progression, and decreases conversion to total hip arthroplasty as compared with core decompression alone.^{5,6}

Hyperbaric oxygen therapy (HBOT) has also gained attention as an adjunctive treatment for early-stage AVN by increasing tissue oxygen tension, promoting angiogenesis, reducing bone marrow edema, and enhancing bone remodeling.⁷ Further, comprehensive rehabilitation focusing on hip mobility, muscle strengthening, gait retraining, and functional restoration is essential for optimizing postoperative recovery. Curcumin, a naturally occurring polyphenol, exhibits potent anti-inflammatory and anti-oxidant properties through modulation of NF- κ B signalling and inflammatory cytokines, potentially contributing to musculoskeletal healing and symptomatic relief.⁸

Although individual therapeutic modalities have demonstrated encouraging clinical outcomes, evidence supporting an integrated multimodal orthobiologic approach remains limited. Combining mechanical decompression with regenerative cell therapy, platelet-derived biological augmentation, HBOT, structured rehabilitation, and anti-inflammatory nutritional supplementation may contribute synergistic effects that enhance tissue repair while preserving the native hip joint.

Here, we present the successful management of a 37-year-old male with Grade IIB avascular necrosis of the femoral head using an integrative orthobiologic protocol consisting of PCD with BMAC augmentation, platelet booster therapy, HBOT, structured rehabilitation, and curcumin supplementation. At six months of follow-up, the patient demonstrated substantial improvements in pain, hip range of motion, muscle strength, gait, and OHS, highlighting the potential of multimodal regenerative strategies for joint preservation.

CASE REPORT

Patient history and clinical presentation

A 37-year male presented with a chief complaint of right hip joint pain and discomfort for 8 months and aggravated during activities like walking, squatting, accessing stairs, ramps and driving.

Family history

No such cases were reported in the family.

Psycho social history

Persistent lower back pain significantly limited the patient's mobility and contributed to psychological stress. However, no formal psychiatric consultation was sought.

Genetic information

No relevant genetic testing was performed.

Relevant past interventions

Patient complained with Right Hip joint pain and discomfort while walking.

Clinical findings

At initial presentation, the patient reported moderate pain with a VAS score of 6/10. On observation, he exhibited a mesomorphic, antalgic gait pattern. Palpation revealed Grade II tenderness anterior aspect of hip and medial (Groin) regions. Range of motion (ROM) assessment demonstrated significant restriction on the affected side: hip flexion was 100° on the right (Painful) and 135° on the left, extension was 15° on the right and 20° on the left, internal rotation was 10° on the right and 35° on the left.

Muscle strength, assessed using the Oxford Manual Muscle Testing (MMT) scale, showed reduced power in the affected limb: hip flexors were graded 3/5 on the right and 5/5 on the left, hip extensors 4/5 on the right and 5/5 on the left, hip abductors 3/5 on the right and 5/5 on the left, and rotators 3/5 on the right and 5/5 on the left and the OHS 33. Magnetic resonance imaging (MRI) of the hips (dated 09/09/2025) revealed findings consistent with avascular necrosis of the right femoral head, classified as Ficat-Arlet Stage II B.

Therapeutic intervention

The patient was admitted for management of right hip AVN. Under spinal anesthesia, the hip region was prepared and draped under sterile conditions. Under fluoroscopic and PCD guidance BMAC augmented with PRP was performed using a decompression needle power drive.^{5,6}

Rehabilitation

Rehabilitation includes guided core stabilization and strengthening, hip, pelvis mobility and strengthening and gait training and modification for 3-4 days / week.

Supplementation

Curcumin of 95–1000 mg capsule was administered after breakfast for 60 days.

HBOT

15 Sessions for a duration of 60 minutes; pressure - 2.0 ATA for 2-3 sessions/week was undertaken.

The patient was discharged in stable condition after 24 hours of hospitalization.

Follow-up and outcomes

Clinical outcomes were assessed at baseline (day of intervention) and at 6 months post-procedure using the VAS, hip range of motion (ROM), and muscle strength evaluated by the Oxford Manual Muscle Testing (MMT) scale.

A marked reduction in pain was observed, with the VAS score improving from 6/10 at baseline to 1/10 at 6 months, indicating substantial symptomatic relief. Hip range of motion demonstrated significant functional improvement over the follow-up period. At baseline, hip flexion was 100° (painful) in the right hip and 135° in the left hip, which improved to 125° (right) and 135° (left) at 6 months. Hip extension improved from 15° (right) and 20° (left) to 20° (right) and 20° (left). Internal rotation increased from 10° (right) and 35° (left) at baseline to 30° (right) and 35° (left) at follow-up.

Muscle strength assessment using the Oxford MMT scale revealed progressive improvement across all muscle groups. Hip flexor strength improved from 3/5 (right) and 5/5 (left) at baseline to 5/5 (right) and 5/5 (left) at 6 months. Hip extensor strength increased from 4/5 (right) and 5/5 (left) to 5/5 bilaterally. Hip abductor strength improved from 3/5 (right) and 5/5 (left) to 5/5 bilaterally. Similarly, rotator muscle strength improved from 3/5 (right) and 5/5 (left) at baseline to 5/5 bilaterally at 6 months follow-up.

DISCUSSION

The primary objective in the management of early-stage osteonecrosis of the femoral head is to preserve the native hip joint, alleviate pain, restore function, and prevent progression to femoral head collapse. In the present case, a multimodal orthobiologic treatment strategy consisting of PCD with BMAC, HCP booster therapy, HBOT, structured rehabilitation, and curcumin supplementation resulted in substantial clinical improvement over six

months. The patient experienced a reduction in pain (VAS 6 to 1), improvements in OHS (33 to 43), restoration of hip range of motion and muscle strength, with normalization of gait, indicating a successful joint-preserving outcome.

Core decompression remains the standard joint-preserving surgical intervention for precollapse osteonecrosis because it reduces intraosseous pressure, improves vascular perfusion, and relieves pain. However, its effectiveness as a standalone procedure is variable, particularly in patients with medium- to large-sized necrotic lesions. Consequently, biological augmentation has emerged as a promising strategy to enhance bone regeneration and delay disease progression.^{1,3}

BMAC has attracted considerable attention because it provides a concentrated source of mesenchymal stromal cells, hematopoietic progenitor, endothelial progenitor cells, and bioactive cytokines that collectively promote osteogenesis, angiogenesis, immunomodulation, and tissue repair. Mesenchymal stromal contribute to regeneration through differentiation into osteoblasts and by secreting trophic factors that reduce inflammation and stimulate endogenous repair mechanisms. Several systematic reviews and meta-analyses have demonstrated that combining BMAC with core decompression improves functional outcomes and decreases the likelihood of femoral head collapse and subsequent total hip arthroplasty compared with core decompression alone.^{5,6}

Platelet-derived orthobiologic further enhance tissue healing by delivering high concentrations of growth factors, including platelet-derived growth factor (PDGF), transforming growth factor- β (TGF- β), vascular endothelial growth factor (VEGF), and insulin-like growth factor-1 (IGF-1). These molecules stimulate angiogenesis, extracellular matrix synthesis, cellular proliferation, and bone remodelling. Although evidence regarding high-concentrated platelet (HCP) therapy in AVN is still evolving, platelet-derived biologics have demonstrated encouraging regenerative potential when used in combination with stem cell-based therapies.⁹⁻¹²

HBOT may have provided additional therapeutic benefit in this patient by increasing oxygen delivery to ischemic bone, reducing bone marrow edema, stimulating angiogenesis, and improving osteoblast activity probably mediated through increased mitochondrial turnover. Previous clinical studies have reported that HBOT reduces pain and improves hip function in patients with early-stage AVN, particularly when combined with other joint-preserving interventions.⁷

Rehabilitation constituted an essential component of the overall treatment strategy. Progressive mobility exercises, strengthening of the hip and pelvic musculature, gait retraining, and core stabilization further contributed to towards restoring biomechanics and improving functional recovery. The improvement of muscle strength from

Medical Research Council grades 3-4/5 to normal strength 5/5 across all major hip muscle groups highlights importance of integrating biological, therapies with evidence-based physiotherapy.

Curcumin supplementation was incorporated because of its anti-inflammatory and anti-oxidant properties. Experimental studies have demonstrated that curcumin suppresses nuclear factor-kappa B (NF- κ B), tumour necrosis factor- α (TNF- α), interleukin-1 β (IL-1 β), and oxidative stress pathways involved in osteonecrosis and bone remodelling.⁸ The favorable outcome observed in this case is likely attributable to the synergistic effects of mechanical decompression, cellular therapy, growth factor supplementation, improved tissue oxygenation, rehabilitation and nutritional support rather than any single intervention. This regenerative strategy addresses multiple pathological mechanisms underlying osteonecrosis, including ischemia, impaired osteogenesis, inflammation and biomechanical dysfunction.

Nevertheless, this report has several limitations. It represents the outcome of a single patient with a relatively short follow-up period of six months. The individual contribution of each treatment modality cannot be determined, and advanced imaging parameters quantifying bone regeneration were unavailable. Larger prospective studies and randomized controlled trials are required to validate the long-term efficacy, safety, and cost-effectiveness of multimodal integrative orthobiologic protocols for osteonecrosis of the femoral head.

CONCLUSION

This case demonstrates that an integrative orthobiologic strategy combining percutaneous core decompression, bone marrow aspirate concentrate augmentation, high-concentrated platelet booster therapy, hyperbaric oxygen therapy, structured rehabilitation, and curcumin supplementation was associated with substantial improvements in pain, hip function, muscle strength, gait, and quality of life in a patient with Grade IIB osteonecrosis of the femoral head. The multimodal approach appears to promote biological repair while preserving the native hip joint and may delay or reduce the need for total hip arthroplasty in carefully selected patients with early-stage disease. Although these findings are encouraging, larger controlled studies with longer follow-up are necessary to establish standardized treatment protocols and determine the long-term clinical benefits of comprehensive orthobiologic therapy in femoral head osteonecrosis.

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REFERENCES

1. Mont MA, Salem HS, Piuze NS, Goodman SB, Jones LC. Nontraumatic osteonecrosis of the femoral head: where do we stand today? A 5-year update. J Bone Joint Surg Am. 2020;102(12):1084-99.
2. Yoon BH, Mont MA, Koo KH, Chen CH, Cheng EY, Cui Q, et al. The 2019 revised version of Association Research Circulation Osseous staging system of osteonecrosis of the femoral head. J Arthroplasty. 2020;35(4):933-40.
3. Pierce TP, Jauregui JJ, Elmallah RK, Lavernia CJ, Mont MA, Nace J. A current review of core decompression in the treatment of osteonecrosis of the femoral head. Curr Rev Musculoskelet Med. 2015;8(3):228-32.
4. Learmonth ID, Maloon S, Dall G. Osteonecrosis of the femoral head: diagnosis and management. BMJ. 2022;376.
5. Agarwala S, Vijayvargiya M, Shah S. Core decompression and bone marrow aspirate concentrate injection for avascular necrosis of the femoral head: a scoping review. J Clin Orthop Trauma. 2022; 24: 101691.
6. Li M, Chen D, Ma Y, Zheng M, Zheng Q. Stem cell therapy combined with core decompression versus core decompression alone in the treatment of avascular necrosis of the femoral head: a systematic review and meta-analysis. J Orthop Surg Res. 2023;18(1):560.
7. Camporesi EM, Vezzani G, Bosco G, Mangar D, Bernasek TL. Hyperbaric oxygen therapy in femoral head necrosis. J Arthroplasty. 2010;25(6 Suppl):118-23.
8. Hewlings SJ, Kalman DS. Curcumin: a review of its effects on human health. Foods. 2017;6(10):92.
9. Andia I, Maffulli N. Platelet-rich plasma for managing pain and inflammation in osteoarthritis. Nat Rev Rheumatol. 2013;9(12):721-30.
10. Hernigou P, Poignard A, Beaujean F, Rouard H. Percutaneous autologous bone-marrow grafting for non-traumatic osteonecrosis of the femoral head. J Bone Joint Surg Am. 2002;84(10):1720-8.
11. Hernigou P, Beaujean F. Treatment of osteonecrosis with autologous bone marrow grafting. Clin Orthop Relat Res. 2002;(405):14-23.
12. Hua KC, Yang XG, Feng JT, Wang F. Clinical efficacy of core decompression combined with bone marrow mesenchymal stem cells in early osteonecrosis of the femoral head: a systematic review and meta-analysis. J Orthop Surg Res. 2023;18:560.

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