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Case Report

A case of avascular necrosis of femoral head managed with bone marrow aspirate concentrate and platelet rich plasma as combination therapy: an orthobiologics approach

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ABSTRACT

Avascular necrosis (AVN) of the femoral head is a debilitating condition and a delay in the intervention(s) invariably results in the necrosis of the femoral head with secondary changes leading to its collapse. Early intervention by regenerative therapy/minimally invasive approach aim to delay or prevent joint replacement. 42-year-old male patient diagnosed for Bilateral AVN of the femoral head, Ficat–Arlet Stage II with key imaging findings of edema in both femoral heads. a cystic lesion (1.4 x 1.0 cm) in the left femoral neck, and Kerboul angles indicating moderate risk for collapse (Right: 180º; Left: 164º). The patient underwent intervention using minimally invasive percutaneous core decompression (PCD) augmented with autologous Bone Marrow Aspirate Concentrate (BMAC) and Platelet-Rich Plasma (PRP) into the necrotic zone monitored by fluoroscopy. The clinical outcomes show that combination of PCD, BMAC and PRP demonstrated beneficial effects post therapy at 12 months, evidenced by reduction in Numeric Pain Rating Scale (NPRS) dropped from 6/10 (pre-op) to 1-2/10 at 12 months and functional improvement measured by Oxford Hip Score (OHS) from 23 (severe/moderate) to 42 (Satisfactory joint function). Further MRI at 6 months reveal revascularization and restoration of marrow signal intensity in necrotic area. This case supports the use of Orthobiologics (BMAC + PRP) as an effective "joint-preserving" strategy for early-stage AVN. By leveraging osteogenic potential of stem cells and angiogenic properties of growth factors to delay or prevent the need for total hip arthroplasty (THA) in younger patients.

Keywords: Avascular necrosis, Bone marrow aspirate concentrate, Platelet rich plasma, Regenerative orthopaedics, Femoral head.

INTRODUCTION

AVN of the femoral head is a progressive and debilitating condition caused by compromised blood supply to the femoral head, ultimately resulting in osteocyte death, subchondral collapse, and secondary degenerative complications. The disorder predominantly affects younger and middle-aged adults, significantly impacting quality of life and imposing a substantial socioeconomic burden, often necessitating total hip arthroplasty (THA).[1] Common predisposing factors include corticosteroid use, alcohol abuse, trauma, and idiopathic causes.[2]

Conventional treatment modalities for AVN include pharmacotherapy, core decompression, and vascularized bone grafting, which aim to control disease progression and delay structural deformity.[3] Recent advances in regenerative orthopaedics have introduced biological adjuncts such as BMAC and PRP. These therapies are rich in growth factors and mesenchymal stem cells that promote osteogenic repair and neovascularization, reduce inflammation through recruitment of reparative cells, and stimulate extracellular matrix synthesis.[4-6] Consistent with these findings, several reports in the literature have demonstrated favourable outcomes with the use of BMAC and PRP in early-stage AVN.[7,8] The present case report describes the successful management of early-stage AVN using BMAC and PRP and highlights the clinical outcome.

CASE REPORT

Patient information

A 42-year-old male patient was diagnosed with avascular necrosis (AVN) involving both hip joints for more than one year. He reported progressively worsening pain, with greater severity in the left hip over the preceding six months.

Medical history

The patient reported a fall while walking eight months prior to presentation. On clinical examination, mild tenderness on deep palpation was noted in the anterior groin region of both hip joints. The patient exhibited a limp secondary to progressive pain, which prompted him to seek medical consultation. Imaging studies of both hips dated 29/08/2023 revealed AVN of both femoral heads, classified as Stage II AVN bilaterally. Vital parameters, including blood pressure and complete blood profile (CBP), were assessed and found to be within normal limits.

Family history

No significant family history was reported.

Psychosocial history

Persistent hip 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

Following the fall eight months earlier, imaging confirmed bilateral hip AVN.

Clinical findings

The patient presented with bilateral hip AVN of one-year duration, with progressive worsening of pain, particularly in the left hip over the last six months.

Diagnostic assessment

Clinical examination revealed mild tenderness on deep palpation over the anterior groin region of both hip joints. Magnetic resonance imaging (MRI) of both hips dated 29/08/2023 was suggestive of Stage II AVN of the bilateral femoral heads.

Therapeutic intervention

The patient was admitted for management of bilateral hip AVN. Under spinal anaesthesia, 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.[8] The patient was discharged in stable condition after 24 hours of hospitalization.

Follow-up and outcomes

Clinical outcomes were assessed at baseline (day of treatment), 6 months, and 12 months post-procedure using the OHS for functional assessment and the NPRS for pain evaluation. The OHS demonstrated progressive improvement from 23 at baseline to 36 at 6 months and 42 at 12 months. Similarly, NPRS scores showed a reduction in pain from 6/10 at baseline to 3/10 at 6 months and 1–2/10 at 12 months (Table 1).

Table 1: Time line OHS (functional) and NPRS (pain).

Time line	OHS	NPRS
0 day – day of treatment	23	6/10
6 months	36	3/10
12 months	42	1-2/10

MRI performed at 6 months demonstrated evidence of revascularization with a reduction in the necrotic area, indicating the onset of the reparative process (image not shown).

Bilateral hip imaging findings

Right hip:

Femoral head edema consistent with Grade II AVN changes (Ficat and Arlet classification)

Kerboul angle: 180° (moderate risk group)

Nishi classification: Type B (<2/3 of weight-bearing area involved)

Mild right hip joint effusion

Remaining visualized bones demonstrated normal signal intensity

No synovial thickening or abnormal signal in the joint capsule

Ligaments, muscles, and tendons around the hip joint showed normal morphology and signal

Visualized pelvic organs and bilateral sacroiliac joints appeared normal

Left hip

Femoral head edema consistent with Grade II AVN changes (Ficat and Arlet classification)

Cystic lesion measuring 1.4 × 1.0 cm noted in the neck of the left femur

Kerboul angle: 164° (moderate risk group)

Nishi classification: Type B (<2/3 of weight-bearing area involved)

Mild left hip joint effusion

Remaining visualized bones demonstrated normal signal intensity

No synovial thickening or abnormal signal in the joint capsule

Ligaments, muscles, and tendons around the hip joint showed normal morphology and signal

Visualized pelvic organs and bilateral sacroiliac joints appeared normal.

DISCUSSION

AVN of femoral head remains a challenging orthopaedic condition, particularly in young adults for whom joint-preserving strategies are strongly favoured. The pathophysiology of AVN is multifactorial and includes compromised vascular supply, diminished osteogenic activity, bone marrow edema, and progressive subchondral collapse. Conventional interventions such as core decompression may provide temporary symptomatic relief; however, their effectiveness is often limited by the poor intrinsic regenerative capacity of necrotic bone. These limitations have driven increasing interest in orthobiologics therapies aimed at restoring osteogenesis, modulating inflammation, and promoting local vascular regeneration.[9,10] BMAC has emerged as one of the most extensively studied regenerative modalities for early-stage AVN. Its therapeutic potential is attributed to its rich composition of Mesenchymal stromal cells (MSCs), hematopoietic progenitors, and bioactive cytokines that facilitate osteoblastic differentiation and neovascularization. Hernigou et al demonstrated that implantation of autologous bone marrow cells into necrotic lesions led to improved structural remodelling and reduced disease progression compared with core decompression alone.[11] Subsequent clinical studies and systematic reviews have supported these findings, reported superior pain relief and delayed radiologic progression in patients treated with autologous bone marrow–derived cells over long-term follow-up.[4-12]

PRP provides an additional biologic benefit through its high concentration of platelet-derived growth factors, including platelet-derived growth factor (PDGF), transforming growth factor–β (TGF-β), vascular endothelial growth factor (VEGF), and epidermal growth factor (EGF). These factors play key roles in angiogenesis, extracellular matrix synthesis, and modulation of the early inflammatory milieu. Although PRP alone may not reverse established osteonecrosis, evidence suggests that it enhances the regenerative efficacy of MSC-based therapies by improving cell recruitment, survival, and local biological activity within the femoral head microenvironment.[6-13]

The combined use of BMAC and PRP has therefore gained attention as a synergistic regenerative strategy. Mid-term clinical studies have reported improved pain scores, better functional outcomes, and a delayed need for total hip arthroplasty when both biologics are used adjunctively in early-stage AVN.[14,15] In the present case, the patient demonstrated clinically meaningful improvements in pain and mobility, along with radiologic stabilization, following intraosseous administration of combined BMAC and PRP. These outcomes are consistent with existing literature and support the biological rationale that the multipotent cellular components of BMAC, coupled with PRP-derived growth factors, enhance the reparative capacity of necrotic bone.

Despite these encouraging findings, clinical outcomes remain variable. Factors such as disease stage, lesion size, bone marrow cellular quality, preparation protocols, and patient-specific risk factors may significantly influence therapeutic response. While this case contributes to the growing body of evidence supporting combined biologic therapy, high-quality prospective trials are still necessary to refine patient selection criteria, establish standardized preparation techniques, and evaluate long-term durability.

CONCLUSION

This case highlights the potential role of combined BMAC and PRP therapy as a joint-preserving treatment option for early-stage avascular necrosis of the femoral head. The observed clinical improvement and radiologic stabilization support the regenerative potential of Orthobiologics therapies in enhancing bone remodelling

and modulating disease progression. Although the results are promising, they must be interpreted in the context of variability reported across clinical studies. Larger, well-designed controlled trials with standardized methodologies are required to define best practices, identify optimal candidates, and confirm the long-term benefits of this approach. Nevertheless, this case provides valuable clinical insight into the evolving role of Orthobiologics in the management of AVN.

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