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# 'Core Decompression and Stem Cell Therapy: A Dual Approach to Defeating Hip Avascular Necrosis and Joint Preservation.'

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**ABSTRACT**
Bilateral avascular necrosis (AVN) is an advanced and crippling condition that results from the disruption of blood flow to bone tissue, leading to pain, functional impairment, and the potential for joint collapse. This case report presents a patient with a one-month history of right hip pain, which progressively worsened over the past two weeks, ultimately leading to a diagnosis of bilateral AVN—Stage 3 in the right hip and Stage 2 in the left. Comprehensive imaging studies, including X-rays, MRI, and CT scans, revealed lytic lesions with sclerotic borders in both femoral heads, consistent with advanced AVN. On December 19, 2024, the patient underwent bilateral core decompression in combination with the application of Bone Marrow Aspirate Concentrate (BMAC) under spinal anesthesia. Core decompression serves to reduce intraosseous pressure, thereby alleviating pain and restoring vascularity to the ischemic bone. The addition of BMAC, which is rich in mesenchymal stem cells, enhances bone regeneration by stimulating osteogenesis and promoting the healing of necrotic regions. This combined approach represents a compelling alternative to total joint arthroplasty, particularly in patients with initial to moderate stages of AVN who seek to preserve the natural hip joint. The case highlights the importance of prompt diagnosis and a tailored treatment approach, focusing on symptom relief, joint preservation, and delaying the need for more invasive procedures. By addressing both the biomechanical and biological aspects of AVN, this strategy offers significant potential for improving clinical outcomes and preserving long-term joint function.
**Key words:** Avascular necrosis, hip decompression, BMAC, stem cells.

## I. INTRODUCTION

Bilateral avascular necrosis (AVN), also known as osteonecrosis, is a serious condition caused by the death of bone tissue due to a compromised blood supply. When both hip joints are affected, it often leads to considerable pain, limited mobility, and functional impairment, presenting substantial challenges for recovery. A multidisciplinary approach, combining early diagnosis with personalized treatment strategies, is essential for managing this debilitating condition [1].

AVN typically occurs when blood flow to specific bone regions is interrupted, depriving the tissue of oxygen and nutrients. This results in the deterioration and weakening of the bone. If left untreated, the bone structure can collapse, causing further complications. Key risk factors include traumatic injuries, prolonged use of high-dose corticosteroids, excessive alcohol consumption, and systemic conditions such as lupus or sickle cell disease. The bilateral nature of the disorder amplifies the discomfort and mobility restrictions, severely impacting the patient's standard of living 2][3].

One of the main challenges in treating AVN is its subtle onset. In the beginning stages, the condition may be asymptomatic, making detection and intervention difficult. As it progresses, individuals often experience persistent, aching pain in the affected joints, along with stiffness and swelling, especially during physical activity. Rest may provide temporary relief. In later stages, joint movement becomes severely limited, complicating daily tasks. If not managed, bilateral AVN can lead to joint degeneration, osteoarthritis, and significant disability [4].

Prompt and accurate diagnosis is crucial for effective treatment. A thorough medical history and physical examination help identify potential risk factors, while imaging studies confirm the diagnosis. X-rays are useful in later stages for detecting bone damage, but magnetic resonance imaging (MRI) is considered the gold standard for detecting early changes in bone marrow. Bone scans may also provide valuable information regarding blood flow and necrotic areas [5].

Treatment options vary according to disease development and symptom severity. In the early stages, conservative measures focus on slowing the progression of the condition and

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managing symptoms. These strategies may include weight management, physical therapy, and assistive devices to reduce joint stress. Medications such as bisphosphonates or anticoagulants may be prescribed to improve bone health and restore blood flow [6].

For more advanced cases, surgical intervention may be necessary to restore joint function and alleviate pain. Core decompression, a procedure that relieves pressure within the bone and encourages the formation of new blood vessels, is commonly used in early stages. In cases of severe joint damage, total joint replacement may be recommended to replace the affected joint and improve mobility and overall wellness. [7]

A patient-centered approach is key in managing bilateral AVN. Treatment plans should be tailored to each individual's specific needs, taking into account their unique risk factors, the stage of the disease, and lifestyle considerations. By combining early detection, personalized interventions, and comprehensive care, healthcare providers can enhance joint function and minimize disability [8].

**Patient History**

A patient presented with a one-month history of right hip pain, which had intensified over the past 15 days, particularly after squatting, significantly affecting daily activities. The patient had no notable past medical history. On examination, the patient was conscious and oriented, with a Glasgow Coma Scale score of 15/15. Systemic examinations were unremarkable, but local examination revealed a painful range of motion in the right hip. Imaging studies, including X-rays and an MRI of the pelvis dated December 10, 2024, indicated bilateral avascular necrosis (AVN), classified as Stage 3 in the right hip and Stage 2 in the left hip. A CT scan of the hip joints revealed mixed lytic lesions with sclerotic borders in both femoral heads, involving 60–70% of the right and 30–40% of the left femoral head, with minimal contour irregularity on the right side, (Fig.1). These findings are consistent with bilateral AVN, more advanced in the right hip. AVN of the femoral head is characterized by bone tissue death due to disrupted blood supply, leading to joint pain and potential collapse. Subsequently, on December 19, 2024, the patient underwent bilateral core decompression with Bone Marrow Aspirate Concentrate (BMAC) application under spinal anesthesia. Early-onset AVN may be managed with procedures like core decompression to promote revascularization, while advanced stages might require joint replacement surgeries. In this case, the patient underwent bilateral core decompression with BMAC application, aiming to enhance regenerative potential and improve outcomes. Timely diagnosis and intervention are crucial in AVN to reduce pain and delay disease progression.

**[Fig.1]**

## II. DISCUSSION

Core decompression is a minimally invasive surgical intervention for addressing avascular necrosis (AVN) during its incipient stages (Stage 1 and Stage 2), particularly before substantial bone collapse develops. [1][9]The primary objectives of this procedure are to reduce pain, retard or halt the advancement of the disease, and to restore the vascular supply to the ischemic bone tissue. Unlike total hip replacement (THR), a more invasive operation entailing the substitution of the damaged joint, core decompression seeks to conserve the patient's intrinsic joint while fostering healing within the compromised bone structure.[10][12]

During the core decompression procedure, one or several diminutive apertures are drilled into the affected bone, typically the femoral head in cases of hip AVN. This technique serves to alleviate the intraosseous pressure resulting from the accumulation of necrotic tissue and reinstates blood circulation to the remaining viable bone. The reduction in pressure provides analgesia, while the enhancement of vascularization promotes the survival and regeneration of healthy bone matter. Depending on the extent of the necrosis, surgeons may opt to drill a solitary channel or multiple

channels to comprehensively address the affected region.[13][11]

Bone marrow aspiration is frequently integrated into this procedure to amplify its therapeutic efficacy. Bone marrow is generally extracted from the iliac crest (the superior portion of the pelvic bone) and processed to isolate mesenchymal stem cells, which possess regenerative and reparative properties. These concentrated stem cells are subsequently injected into the drilled area to stimulate the formation of healthy bone tissue and facilitate the repair of the necrotic region. This combined modality—core decompression augmented by stem cell therapy—has demonstrated improved clinical outcomes, as it concurrently addresses both the biomechanical and biological facets of AVN.[14]

Core decompression is preferentially employed over total hip replacement in select cases for various reasons

Joint Preservation: Core decompression is aimed at conserving the patient's natural hip joint rather than replacing it with an artificial prosthesis. Retaining the original joint is especially advantageous for younger and more active patients, as it preserves long-term functionality and avoids the constraints associated with prosthetic joints. [11]

Postponement or Avoidance of THR in younger individuals, deferring a total hip replacement is imperative, as artificial joints have a finite lifespan (typically 15–20 years) and may necessitate revision surgery, which is often more intricate and fraught with increased risks. Core decompression, if successful, can delay or obviate the requirement for joint replacement. [13][10]

Minimally Invasive Nature Compared to the more invasive nature of hip replacement, core decompression is a less intrusive procedure, offering reduced recovery times, fewer complications, and shorter hospital stays. This is of particular benefit to patients in the early stages of AVN, where joint damage has yet to be extensive.[14] Improved Prognosis in preliminary phases. When performed during the initial stages, core decompression can effectively decreases pain, restore functionality, and forestall disease evolution in approximately 70–80% of cases. This high success rate renders it a valuable option for those diagnosed prior to the disease advancing to Stage 3 or Stage 4.[10]

While core decompression proves efficacious in the early stages of AVN, its success wanes in more advanced phases, particularly when the bone has undergone collapse or when the joint is severely compromised. In such instances, total hip replacement becomes the standard of care. Although complications associated with core decompression are infrequent, they may include infection, fractures, and failure to relieve symptoms. In certain cases, the necrosis may continue to progress despite the procedure, necessitating further surgical intervention.[12]

In summary, core decompression paired with bone marrow aspiration represents a promising approach for the management of early-stage hip AVN, offering both pain relief and the preservation of the natural joint. By addressing the underlying causes of necrosis and fostering bone regeneration, this method can delay or obviate the necessity for total hip replacement, thus proving to be a valuable alternative for younger and more active patients.[1][9]

## III. CONCLUSION

In conclusion, managing bilateral avascular necrosis demands a personalized and proactive approach. Early interventions such as core decompression combined with stem cell therapy provide substantial advantages, helping preserve the natural hip joint and encourage bone regeneration. This method can delay or even eliminate the need for total hip replacement, especially in younger, active individuals. Rapid assessment and customized treatment are essential for reducing long-term impairment and optimizing overall results, ultimately enhancing the patient's well-being.

**Conflicts of interest**
There is no conflicts of interest

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**Ethical approval**
Ethical approval was not required for this study.

**Declaration of patient consent**
Patient consent has been acquired, can be submitted for verification.

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