Intraosseous Bone Marrow Aspirate Concentrate for Systemic Avascular Necrosis: A Case Report

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Introduction:

High-dose corticosteroid exposure is a primary risk factor for the development of systemic avascular necrosis (AVN).[1] Characterized by bone infarction with epiphyseal necrosis, AVN is frequently painful with early progression of osteoarthritis and subchondral collapse.[1-5] Surgical intervention has been the mainstay of treatment, however due to the multifocal nature of the condition, less invasive treatment options are needed, particularly for younger patient populations.[2-4] Increasing evidence in the literature shows promise for reducing pain and slowing disease progression with percutaneous intraosseous injection targeting AVN lesions with autologous bone marrow aspirate concentrate (BMAC).[2,5]

Case Presentation:

A 24-year-old female presented to an outpatient orthopedic clinic with six months of progressively worsening left knee pain. Her history was notable for T-cell prolymphocytic leukemia diagnosed at 18, requiring chemotherapy and prolonged high-dose corticosteroids with subsequent development of multifocal AVN after remission. Prior treatments included bilateral total hip arthroplasty (THA), right total knee arthroplasty (TKA), and intraosseous BMAC injections of her left ankle and right elbow.

Her left knee pain was anterior, aching, deep, exacerbated by activity, and more severe at night. She reported difficulty with her usual activities of hiking and resistance training. Physical exam was positive for marked tenderness along the proximal tibial plateau, as well as laxity with valgus and seated anterior drawer stress tests. Recent magnetic resonance imaging (MRI) revealed extensive AVN within the proximal tibia and smaller lesions in the distal femur. Due to good results with prior treatment, the patient opted for intraosseous BMAC injections for treatment.

A 90 cc bone marrow aspiration under ultrasound from the bilateral posterior iliac spines yielded 2.12 billion nucleated cells once concentrated. Fifty percent of the cells were injected into the areas of AVN using ultrasound and fluoroscopic guidance, with the remaining 50% injected intra-articularly and into periarticular soft tissue. There were no significant adverse events. She resumed physical therapy. Her nocturnal pain was completely resolved at week 2 and her daytime pain was reduced by 50% by week 6. She was able to resume hiking, working out and demonstrated increased knee extensor strength on therapy reassessment at week 12.

Discussion:

Systemic AVN frequently progresses to advanced disease in a short period of time, necessitating invasive surgical procedures. Early non-surgical intervention prior to subchondral collapse demonstrate efficacy in

prolonging joint preservation in the literature to date.[4,5] Percutaneous subchondral BMAC injections are theorized to repopulate the diseased region via transplantation of autologous BMAC containing healthy mesenchymal signaling cells that promote tissue repair.[2,5]

Though TKA was also a reasonable option for this patient, BMAC injection has resulted in significant pain reduction and improved function at her current post-treatment time frame of 8 months. Clinical monitoring will continue with repeat MRI imaging at 12 months. Our case report suggests intraosseous BMAC may be a viable alternative to surgery in younger patients with pre-collapse AVN. Large cohort randomized controlled trials are needed for further evaluation.

References:

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