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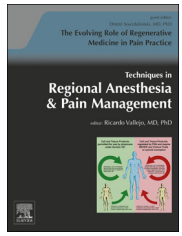

Regenerative medicine injection techniques for the hip pathology

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ABSTRACT

Hip pain is a common complaint that can have both intra-articular and extra-articular origins. Three common causes of hip pain are hip osteoarthritis, iliopsoas tendinopathy, and gluteus medius tendinopathy. Current treatment plans range from conservative measures to surgical replacement. Traditionally, minimally invasive approaches with the use of corticosteroid and local anesthetic injections have served to manage symptoms of pain without altering disease progression. In addition, these agents have been associated with deleterious effects on bone, tendon, and cartilage health. Emerging regenerative medicine techniques are becoming increasingly popular for the management of hip pain, as they have been shown to improve clinical outcomes and potentially alter disease progression. Some of these techniques, such as injection of platelet-rich plasma, mesenchymal stem cells, and percutaneous needle fenestration, have been shown to promote healing of damaged tissue. These techniques are often augmented by the use of ultrasound imaging, which greatly increases ease and accuracy. This article reviews ultrasound-guided regenerative orthopedic injections specifically for hip joint osteoarthritis, gluteus medius tendinopathy, and iliopsoas tendinopathy.

Introduction

"Hip pain" is a common complaint that presents in a multitude of outpatient settings. It can present with both intra-articular and extra-articular etiologies. It is a common presenting problem within the primary care setting with national survey data indicating that 14.3% of patients greater than 60 years of age reported frequent pain.[1] Hip pain is the single largest driving factor for joint replacement; in 2004, over 368,000 hip replacements were performed, costing the health care system $5.3 billion dollars.[2]

Current treatment algorithms for hip pain include a spectrum of interventions, from the least invasive therapies such as exercise and weight loss, to total joint replacement.

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Traditionally, minimally invasive approaches such as corticosteroid injections serve only to mitigate the symptoms, as corticosteroids do not alter the progression of osteoarthritis (OA). In addition to this, injections with corticosteroids and local anesthetics are thought to have deleterious effects on joint health and may even accelerate disease.[3-6]

Recent medical advancements suggest that regenerative orthopedics is a promising line of treatment. Regenerative treatment modalities include the injection of platelet-rich plasma (PRP), mesenchymal stem cells (MSC), and other commercially available amniotic tissue derived products.[7-10] PRP is a supraphysiologic concentration of platelets. Within the platelets are a variety of biologically active growth factors and proteins that are involved in the healing cascade.[7,8] For this reason, PRP has been the subject of significant attention within musculoskeletal medicine. However, preparation for injection has been widely variable across clinical practice. Implementation as standard practice is impeded by PRP composition (as it pertains to differences from donors), widely variable injection schedules that are patterned on existing algorithms set for other types of injections (eg, corticosteroid and hyaluronic acid), and unpredictable local and systemic effects based on injectate cytokine contents.

Despite the barriers noted earlier, local injection of PRP has been effectively used for the treatment of various painful conditions. Use of PRP in conditions such as tendinopathy,[3] muscle strain injury,[4] and ligament injury has shown promise,[5] and it has been associated with significant reduction in pain, disability, functional limitations as well as improved structural integrity and biomechanical strength.[11] A systematic review of level 1 evidence-based studies published in 2015 by Meheux et al highlights the clinical effect of PRP use for the management of symptomatic OA. A total of 6 prospective randomized controlled trials comprising 739 patients undergoing PRP vs viscosupplementation or placebo for knee OA were compared. The authors noted that across all studies, PRP injection resulted in significant clinical improvement in WOMAC scores and outcomes.[12]

Recently, Dallari et al[13] have shown the positive outcomes associated with PRP vs hyaluronic acid in hip joint OA. When compared to hyaluronic acid replacement alone, PRP injection was noted to have statistical improvement in clinical outcomes including the visual analog scale score, Harris Hip score, and WOMAC scores at 1-, 3-, and 6-month follow-ups (with nonstatistically significant improvement at 12 months). In addition, favorable outcomes for PRP injection have been found in the treatment of Achilles tendinopathy, and common extensor tendon at the lateral epicondyle, gluteus medius tendon, and patellar tendonopathy.[14]

Percutaneous ultrasound-guided needle fenestration or tenotomy has been used with promising results in the treatment of tendinopathy.[15,16] Tendon needling involves repeatedly fenestrating the affected tendon, primarily targeting abnormal tendon hypoechogenicity, anechoic clefts, and neovascularity if present, to encourage localized bleeding, fibroblastic proliferation, and ordered collagen formation, ultimately promoting the healing of the tendon. The advantage of this technique is similar to the effect of PRP injection through the recruitment of growth factors via the bleeding effect. This technique is already in use for tendons around the hip and pelvis and with favorable results reported.[17] In addition to PRP, mesenchymal stem cells (MSCs) have also been gaining ground on regenerative applications for degenerative joint disease. MSCs are typically autologous and can be easily derived from the bone marrow or adipose-derived stromal vascular fraction.[18,19] They have a high proliferation and chrondrogenesis potential through their multipotent differentiation capacity. Injection of MSC into rats with induced meniscal damage has shown favorable results with meniscal regeneration; this was also observed in humans injected with MSC.[11,18,20] However, like PRP, standardization remains a barrier for guidelines establishment.

Management techniques for hip pain include the use of ultrasound both for diagnostic and image-guided therapeutic applications. A thorough assessment of hip pathology often includes the use of sonographic imaging to evaluate the structural integrity of the hip joint as well as the surrounding muscle tissue in addition to physical examination and radiological imaging. Although the causes of hip pain are vast, the focus of this review will be on ultrasound-guided regenerative orthopedic injections and procedures for hip OA, gluteus medius tendinopathy, and iliopsoas tendinopathy with bursitis.

Anatomy and sonographic evaluation

Hip joint

The hip joint is a classic "ball and socket" joint and serves as the articulation between the femoral head and the acetabulum. The acetabulum supports the articulation via the acetabular labrum that provides stability to the hip joint. The acetabular labrum is invested by the joint capsule to support a distal connection to the intertrochanteric region and femoral neck. Between these 2 distinct tissues lies the anterior joint capsule that is composed of anterior and posterior layer separated by a recess. The layers can be approximately 4-6 mm in thickness separated by a physiologic fluid with a distance of approximately 2 mm or less. The femoral head and neck junction would be easily recognizable with a uniform layer of cartilage covering the femoral head. The layers of the joint capsule would appear hyperechoic when imaged with the femoral neck perpendicular to the transducer.

Hip joint evaluation is typically performed via an anterior approach. Placement of the transducer along the transverse axis of the femoral neck with movement proximally would aid in locating the greater and lesser trochanter. Once found, the transducer may be rotated to the sagittal-oblique plane of the femoral neck and moved medially. The hip joint is most easily recognizable at this point by observing the shape of the femoral head, acetabulum, and femoral neck and would allow for visualization of the contents of the anterior joint recess (Figure 1). Fluid within the anterior joint recess is typically seen in OA and can support the diagnosis.[21,22]

Normal bone looks smooth, with hyperechoic edge. On ultrasound, bony abnormalities may be appreciated with loss of the smooth contour conferring an uneven ragged edge along with osteophyte extensions. Capsular structure can be appreciated with a small hypoechoic fluid collection