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CASE REPORT

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Ultrasound-Guided Intra-Articular Injection of Bone Marrow Aspirate and Hyaluronic Acid for Atraumatic Shoulder Pain: A Case Report With 12-Month Follow-Up

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ABSTRACT

Background: Atraumatic painful shoulder conditions are common in the adult population, with high prevalence and significant functional impact. Conventional treatments, such as corticosteroid injections, although effective, have been associated with deleterious effects on tendons and cartilage. This study presents a case report of a patient treated with an intra-articular injection of high-molecular-weight hyaluronic acid (HA) combined with autologous bone marrow aspirate (BMA), showing excellent clinical and functional outcomes at 12-month follow-up.

Methods: We report the case of a 33-year-old male with chronic right shoulder pain and no history of trauma, refractory to physical therapy and a previous isolated HA injection. The proposed treatment was an ultrasound-guided intra-articular injection using a mixture of BMA and HA. Bone marrow was harvested from the anterior iliac crest and combined with HA prior to injection. Clinical and radiographic follow-up was conducted over 12 months.

Conclusion: The combination of high-molecular-weight HA and autologous BMA demonstrated safety and effectiveness as a biological alternative for atraumatic shoulder pain, providing sustained functional improvement without complications.

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Introduction

The shoulder is a complex joint composed of three anatomical articulations (glenohumeral, acromioclavicular, and sternoclavicular) and two functional joints (scapulothoracic and subacromial). Its high mobility depends on both joint and muscular integrity, rendering it vulnerable to overload injuries.

Painful shoulder conditions affect between 7% and 34% of adults, with higher prevalence after the age of 40. Atraumatic episodes are common and often show delayed recovery, particularly in individuals aged 45 to 55 years. Corticosteroid injection is a cornerstone of conservative management, although increasing evidence highlights its deleterious effects on tendinous and cartilaginous tissues, including risks of tendon rupture and cartilage degradation [1-3].

Corticosteroids exert both local and systemic actions, though their precise mechanism remains unclear. They are believed to act as potent anti-inflammatory and analgesic agents by reducing capillary dilation and vascular permeability, thereby limiting hyperemia, exudation, pain, and leukocyte infiltration. In addition, corticosteroids are thought to inhibit phospholipase A2 activity, decreasing arachidonic acid production and consequently reducing prostaglandin synthesis, a key contributor to inflammation. Intra-articular corticosteroid injections are effective for rapid pain relief and inflammation control, facilitating functional recovery. However, they are also known to cause vascular damage to tendons and, more critically, to articular cartilage when administered intra-articularly [4-6].

As an alternative, biological therapies have been proposed, such as bone marrow aspirate (BMA), which is rich in mesenchymal stem cells and regenerative factors, combined with hyaluronic acid (HA), a viscoelastic glycosaminoglycan with anti-inflammatory and lubricating properties.

Case Report

A 33-year-old male television reporter presented with chronic right shoulder pain without any history of trauma. He reported pain during weightlifting and gym-related activities. Physical examination revealed positive provocative tests for long head of the biceps tendinopathy, including Speed, O'Brien, and Biceps Load I/II tests. His initial American Shoulder and Elbow Surgeons (ASES) score was 63%. The patient had previously undergone 40 sessions of physical therapy and a prior isolated intra-articular hyaluronic acid (HA) injection, with no symptomatic relief.

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Surgical Tecnique

With the patient in the beach-chair position under general anesthesia combined with an interscalene brachial plexus block, local anesthesia was administered at the bone marrow harvest site using ropivacaine (without vasoconstrictor). A small incision was made, and bone marrow aspirate (BMA) was harvested from the anterior iliac crest using an 11G × 10 cm Jamshidi needle (Figure.1). The needle was gently advanced into the iliac crest using a mallet, reaching a depth of approximately 3–5 cm. A total of 20 mL of bone marrow aspirate was collected and immediately mixed with 4 mL of high–molecular weight hyaluronic acid (Synolis VA®) in a closed three-way system to prevent premature coagulation (Figure.2 and Figure.3).

Under ultrasound guidance, the glenohumeral joint space and the superior insertion of the biceps tendon were identified (Figure.4). The BMA–HA mixture was injected intra-articularly using a 25G × 90 mm spinal needle, with real-time ultrasound visualization confirming intra-articular filling (Figure.5). The iliac crest puncture site was closed with sutures.

Figure 1: 11G × 10 cm Jamshidi bone biopsy needle

Figure 2: Bone marrow aspirate being withdrawn with a 20 mL syringe from the anterior iliac crest of the patient's right hip

Figure 3: Using a three-way cannula to mix hyaluronic acid with bone marrow aspirate

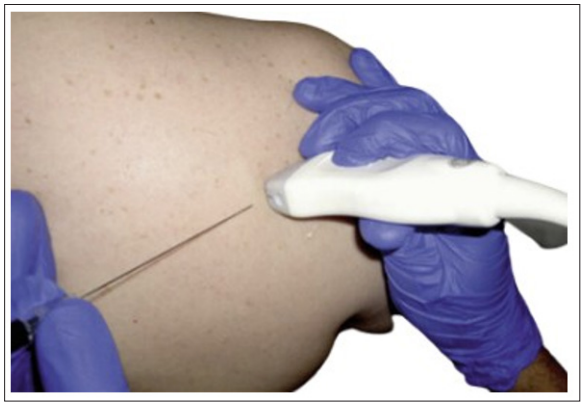

Figure 4: Approaching the posterior region of the shoulder, with the ultrasound probe positioned obliquely, an in-plane injection technique was used

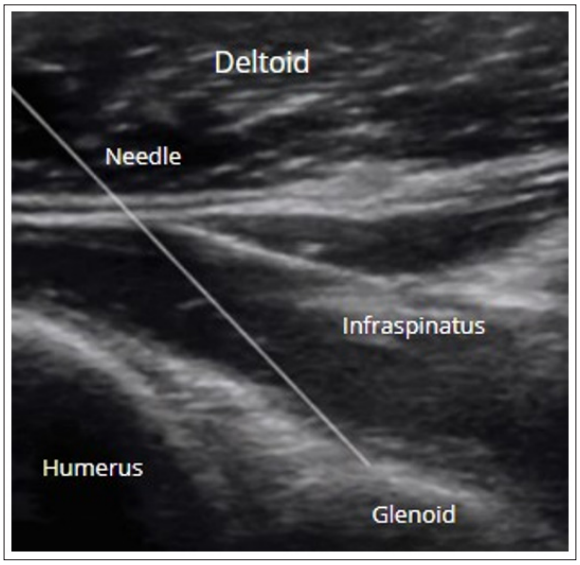

Figure 5: The needle was visualized advancing toward the anterosuperior border of the glenoid, where the injection was performed

Postoperatively, the patient used a sling for 7 days, followed by a progressive rehabilitation protocol with return to full activity after 30 days. Nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroids were avoided.

Results

At 3-month follow-up, the patient demonstrated an ASES score of 95% with all clinical tests negative. At 12 months, the ASES score reached 100%, with full return to activities without limitation. No complications were observed, including Popeye deformity or loss of external rotation. Table 1 shows the comparison of magnetic resonance imaging (MRI) scans performed at the same hospital and interpreted by the same radiologist over a 12-month period.

Table 1

Findings	January 2024	April 2024	January 2025
Acromioclavicular joint	Capsulosynovial hypertrophy and bone marrow edema, suggesting mechanical overload	Congruent joint with subchondral edema in the distal clavicle (mechanical origin)	Regular contours
Glenoid labrum	Degenerative changes and fissure at the posterior superior base	Mild degenerative change in the posterior superior segment, no tear	Preserved, no lesions
Rotator cuff tendons	Supraspinatus and infraspinatus tendinopathy, thickened without full-thickness tear	Preserved rotator cuff	Preserved thickness, continuity, and signal
Long head of the biceps tendon	Intact and in normal position	Intact and in normal position	Preserved in the bicipital groove; normal intra- and extra-articular course
Subacromial/subdeltoid bursa	Mild distension	Slight thickening	No fluid distension

Discussion

Atraumatic shoulder pathologies are predominantly managed in their initial stages through conservative strategies, including physical therapy, analgesics, nonsteroidal anti-inflammatory drugs (NSAIDs), and corticosteroid injections. These approaches are generally effective in achieving symptomatic improvement, particularly in middle-aged patients with lower functional demands. However, in younger and physically active individuals, clinical response may be limited, often requiring surgical interventions such as arthroscopy, which offers a minimally invasive alternative with low morbidity [7,8].

Corticosteroids, such as triamcinolone, are widely used due to their anti-inflammatory and analgesic efficacy. Despite a favorable safety profile, adverse effects may occur, especially with repeated use. Local complications include infection (incidence <0.072%), post-injection flare (2.5%–10%), cutaneous depigmentation (4%), subcutaneous tissue atrophy (<1%), bruising, pericapsular calcification (up to 40%), neurovascular injury, and tendon rupture. Although rare, tendon ruptures have been associated with corticosteroid injections and are thought to result from alterations in tendon biomechanics, including cellular degeneration, reduced type I collagen expression, decreased cell proliferation, and diminished proteoglycan synthesis [9-13].

Systemic effects such as hyperglycemia, facial flushing (<1%), transient hypertension, vasovagal reactions (10%–20%)[2], and anaphylaxis have also been reported, although the latter is rare. Contraindications to injection include local infection, bacteremia or sepsis, bleeding disorders, active local hemorrhage, recent fractures, and hypersensitivity to the injected drug.

Hyaluronic acid (HA) is a non-sulfated glycosaminoglycan (GAG) composed of repeating units of β-1,4-D-glucuronic acid and β-1,3-N-acetylglucosamine. Its key properties include high viscoelasticity, hygroscopicity, biocompatibility, and moisture retention capacity. Even at concentrations as low as 0.1%, HA demonstrates significant viscosity, making it a potent joint lubricant, impact absorber, and regulator of synovial homeostasis. Molecular weight is a critical determinant of its clinical effectiveness: formulations with molecular weight >1000 kDa exhibit greater viscosity, enhanced anti-inflammatory effects, and improved joint lubrication, contributing to biomechanical protection of cartilage and slowing degenerative progression.

In the context of biological therapies, bone marrow aspirate concentrate (BMAC) has emerged as a promising alternative. It is among the most commonly used sources in cell-based therapies due to its simplicity and low donor-site morbidity. Harvested from the medullary cavity of long and axial bones, BMAC contains a diverse range of cellular and molecular components, including hematopoietic cells (neutrophils, lymphocytes, megakaryocytes, monocytes, adipocytes, Schwann cells, and osteoclasts) as well as a high concentration of mesenchymal stem cells (MSCs). These multipotent cells, capable of differentiating into osteogenic, chondrogenic, and tenogenic lineages, represent less than 0.001% of the total cellularity of bone marrow. The anterior iliac crest is often preferred for harvesting due to its anatomical accessibility and high cell yield, comparable to the posterior crest [14].

Beyond their direct regenerative potential in damaged tissues, MSCs play a role in modulating intra-articular inflammation and secreting trophic factors, which support the repair of the surrounding microenvironment. Initial clinical evidence shows promising results; however, randomized controlled trials with long-term follow-up are needed to establish the therapeutic efficacy of BMAC for shoulder disorders with greater certaint.

Conclusion

The use of biological therapies in the treatment of tendinopathies and osteoarthritis has become an area of growing interest,

enhancing the healing environment and promoting both tissue and cartilage regeneration. The treatment of intra-articular shoulder lesions with bone marrow aspirate concentrate (BMAC) combined with hyaluronic acid has gained prominence in recent years, offering a less invasive option. When guided by ultrasound, this approach achieves near 100% accuracy. Further studies are required, along with standardization of preparation and injection protocols.

Level of Evidence: IV.

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