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Operative Techniques in
Orthopaedics

Biologics and Cell-Based Treatments for Upper Extremity Injuries

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Many orthopaedic conditions of the upper extremity can have a protracted course of conservative management during which the patient gains may be unpredictable. More specifically, lateral epicondylitis, medial epicondylitis, and partial ulnar collateral ligament tears can be the cause of debilitating pain that may not have durable long-term relief without a surgical intervention. Recent advances have led to an expanded role of biologics in the treatment of orthopaedic conditions. Some of the developing modalities include blood-derived products, marrow-derived products, and stem cells. Currently, most of the available literature focuses on the use of platelet-rich plasma. Although there is still much research that needs to be done, some of the learn studies suggest a benefit from the use of platelet-rich plasma, especially in regards to pain, to address these conditions.
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Introduction

The literature available on the topic of biologics in the field of orthopaedics is sparse. This is further limited when examining the applications in the upper extremity. In recent years, there has been increasing amounts of published studies that may begin to shed some light on the effectiveness of biologics in the upper extremity. Although there are multitudes of conditions that may one day benefit from the use of biologics, the current upper extremity biologic literature focuses primarily on 2 topics: rotator cuff pathologies and lateral epicondylitis. Applications in the rotator cuff are discussed in a separate article. In this article, we would discuss biologics application in regards to lateral epicondylitis, medial epicondylitis, and ulnar collateral ligament (UCL) injuries.

As previous articles have shown, there are multiple various biological tools in the armamentarium, but most of the literature around the upper extremity is focused on the use of platelet-rich plasma (PRP). Due to the limitations of the current literature, the focus in this article would be primarily on the use of PRP in the earlier mentioned conditions.

Lateral Epicondylitis

Lateral epicondylitis, or tennis elbow, is a common musculotendinous degenerative disorder of the extensor origin at the lateral humeral epicondyle. It is a common cause of lateral elbow pain caused by overuse of the wrist and usually affects adults in the fifth and sixth decades of life. Activities or occupations that involve repetitive wrist extension and supination generate the pathomechanics of excessive loading of the common extensor origin. Similar to the previously discussed medial epicondylitis, the repetitive microtrauma leads to a degenerative process in which fibroblasts and vascular granulation invade the microstructure of collagen.[1,2]

The usual narrative of lateral epicondylitis is an insidious onset of pain. Activities of daily living such as shaking hands, lifting with an extended elbow, or raising a coffee mug can cause significant discomfort. On physical examination, there is tenderness over the common extensor origin just anterior and distal to the lateral humeral epicondyle. Pain can be reproduced with the extended elbow and with resisted middle finger and wrist extension. Flexion of the elbow would reproduce pain if the degenerative process is more severe. Grip strength may be diminished secondary to pain.[2]

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Nonoperative measures are often successful and consist of activity modification, bracing, physical therapy, and injections. Most patients have self-limiting symptoms and recover within 1 year.[3] Similar to the other upper extremity conditions, surgery is reserved for refractory cases that fail to improve with extensive conservative management. Surgery can offer good results with over 90% good to excellent outcomes at 10-year follow-up.[4] The surgical risk still remains including scar, infection, and neurovascular issues. Up to 95% of cases improve without surgical intervention, thus nonoperative management remains the mainstay of treatment.[5] Other causes of lateral elbow pain, such as peripheral nerve compression injuries, should be excluded before surgical considerations.

When formulating a treatment plan, physical therapy is an important component. Eccentric muscle training has demonstrated promising results with significant improvements in both pain and strength.[2] Counterforce bracing may be prescribed as an adjunct to therapy. Patients without medical contraindications are recommended to start a course of nonsteroidal anti-inflammatory drugs although their use has not been supported by high-quality studies. In regards to injections, the most common substances used are corticosteroids. Comparative studies involving corticosteroids vs placebo or physiotherapy seem to favor the use of corticosteroid injections only in the short-term.[6] There are no studies that prove steroids offer long-term resolution of symptoms.[4] Of recent, there has been an increase in the frequency of biologics used to treat this condition that may provide more long-term improvement.

Lateral epicondylitis has been one of the most studied in regards to the use of biologics in the upper extremity, second only to the rotator cuff. Despite multiple studies with promising results, the 2013 National Institute for Health and Clinical Excellence guidelines suggest the evidence remains inadequate regarding PRP and autologous blood injections and that they should only be used for research.[4] In one randomized clinic controlled trial, the researchers compared PRP with an active control group in 225 patients.[4,7] In this study, the primary outcome measures were the visual analog scale (VAS) and the Patient-Related Tennis Elbow Evaluation (PRTEE). Patient was evaluated at 12 and 24 weeks. At 24 weeks follow-up the PRP group had a statistically significant difference in improvement of VAS scores compared with the control, 71.5% and 56.1% respectively. However, the study was underpowered and unreliable at the 24-week time point because only 119 of 225 patients had available data. There were no recorded significant differences between the 2 groups in PRTEE scores.

Another group of researchers compared steroid to PRP injections. They followed 100 consecutive patients for 2 years.[4,8-10] The study was double blinded, and VAS and disabilities of the arm, shoulder, and hand (DASH) scores were used as outcome measures. At 4 weeks follow-up PRP treated patients showed a mean improvement of 21% in VAS scores, steroid treated patients showed a 33% improvement. A similar result was demonstrated at 4 weeks on the DASH score with steroid treated patients showing greater improvement. The findings at 8 weeks also showed increased improvement on both VAS and DASH scores for steroid injections compared with PRP. However, none of the findings at 4 or 8 weeks were statistically significant. At 12 weeks, steroid treated patients outcomes declined whereas the PRP treated patients continued to progressively improve with regards to VAS and DASH scores. At the 6 month, 1 and 2 year follow-up, this trend continued with high levels of significance. This study affirms that steroid injections have better short-term result, which rapidly tapers and declines, whereas PRP injections progressively improve and are superior to steroid with long-term follow-up.

A group of investigators compared PRP with autologous whole blood in a 2011 study.[11] A total of 150 patients who had previously failed conservative physiotherapy were evaluated using the PRTEE outcome measure at 1, 3, and 6 months postprocedure. The results displayed a success rate of 72% in the autologous blood group and 66% in the PRP group, the difference between the 2 treatments was not statistically significant. The study reports that patients who had a successful outcome in the autologous blood group experienced a mean improvement of PRTEE score of 46.8 compared with 35.8 in the PRP group. It must be noted, however, that 20% of patients who received autologous blood went on to surgery before the end of the study compared with only 10% in the PRP group. The authors suggest caution in concluding a true difference between the groups at 6 months. The study shows that both PRP and autologous blood produce a significant decrease in pain levels at 6 months in up to 70% of cases. In a pilot prospective study, the researchers' sonographic assessment was used as the outcome measure.[11] The aim of the study was to determine if PRP is associated with improved tendon morphology and increased vascularity. Under ultrasound (US) guidance, PRP was injected to the area of maximum tenderness and poorest sonographic appearance at the common extensor origin. US appearance was compared with baseline findings (preinjection) at 1 and 6 months. Results showed 3 of 6 patients had improved morphology compared with baseline at 3 months, and all patients in the study had improved morphology at 6 months. This finding was not statistically significant but suggests that PRP increases vascularity to the common extensor origin and improve tendon morphology. Owing to the small size of the study, no definite conclusions can be actually made.

Medial Epicondylitis

Medial epicondylitis, or "golfer's elbow" is frequently evaluated in orthopaedic offices, despite an overall prevalence of 1%. It typically occurs in the fourth through sixth decades of life and equally affects men and women.[1] Repetitive supraphysiologic stress on the common flexor tendon, due to eccentric loading of the muscles responsible for wrist flexion and forearm pronation combined with valgus overload at the elbow, eventually results in microtrauma and degeneration.[12,13] Initially, repetitive trauma results in peritendinous inflammation and with continued injury angiofibroblastic hyperplasia takes place. Ultimately, the normal tendon is replaced with angiofibroblastic hyperplasia the consequence of which is