Platelet-Rich Plasma Can Be Used to Successfully Treat Elbow Ulnar Collateral Ligament Insufficiency in High-Level Throwers

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Abstract

We conducted a study to evaluate the effect of platelet-rich plasma (PRP) injections on partial ulnar collateral ligament (UCL) tears in high-level throwing athletes. We retrospectively reviewed the cases of 44 baseball players (6 professional, 14 college, 24 high school) treated with PRP injections for partial-thickness UCL tears. All tears were diagnosed by physical examination and confirmed by magnetic resonance imaging (MRI). Sixteen patients had 1 injection, 6 had 2, and 22 had 3. Once patients became asymptomatic after injection, they were started on an interval throwing program. Physical examination findings at final follow-up were classified according to a modified version of the Conway Scale.

Mean age was 17.3 years (range, 16-28 years). All patients were available for follow-up after injection (mean, 11 months). Of the 44 patients, 15 (34%) had an excellent outcome, 17 had a good outcome, 2 had a fair outcome, and 10 had a poor outcome. After injection, 4 (67%) of the 6 professional players returned to professional play. Twenty-two patients had proximally based partial-thickness tears, 7 had distally based partial tears, and 15 had diffuse signal without partial tear on MRI. Mean time from injection to return to throwing was 5 weeks; mean time to return to competition was 12 weeks (range, 5-24 weeks). There were no injection-related complications.

Our use of PRP in the treatment of UCL insufficiency produced outcomes much better than earlier reported outcomes of conservative treatment of these injuries. PRP injections may be particularly beneficial in young athletes who have sustained acute damage to an isolated part of the ligament and in athletes unwilling or unable to undergo the extended rehabilitation required after surgical reconstruction of the ligament.

For overhead athletes, elbow ulnar collateral ligament (UCL) insufficiency is a potential career-ending injury. Baseball players with UCL insufficiency typically complain of medial-sided elbow pain that affects their ability to throw. Loss of velocity, loss of control, difficulty warming up, and pain while throwing are all symptoms of UCL injury.

Classically, nonoperative treatment of UCL injuries involves activity modification, use of anti-inflammatory medication, and a structured physical therapy program. Asymptomatic players can return to throwing after a structured interval throwing program. Rettig and colleagues[1] found a 42% rate of success in conservatively treating UCL injuries in throwing athletes.

UCL reconstruction is reserved for players with complete tears of the UCL or with partial tears after failed conservative treatment. Several techniques have been used to reconstruct the

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ligament, but successful outcomes depend on a long rehabilitation process. According to most published series, 85% to 90% of athletes who had UCL reconstruction returned to their previous level of play, but it took, on average, 9 to 12 months.[2,3] This prolonged recovery period is one reason that some older professional baseball players, as well as casual high school and college players, elect to forgo surgery.

Over the past few years, platelet-rich plasma (PRP) has garnered attention as a bridge between conservative treatment and surgery. PRP refers to a sample of autologous blood that contains a platelet concentration higher than baseline levels. This sample often has a 3 to 5 times increase in growth factor concentration.[4-6] Initial studies focused on its ability to successfully treat lateral epicondylitis.[7-9] More recent clinical work has shown that PRP can potentially enhance healing after anterior cruciate ligament reconstruction,[10-14] rotator cuff repair,[15-17] and subacromial decompression.[11,18-23]

If PRP could be used to successfully treat UCL insufficiency that is refractory to conservative treatment, then year-long recovery periods could be avoided. This could potentially prolong certain athletes' careers or, at the very least, allow them to return to play much sooner. In the present case series, we hypothesized that PRP injections could be used to successfully treat partial UCL tears in high-level throwing athletes, obviating the need for surgery and its associated prolonged recovery period.

Materials and Methods

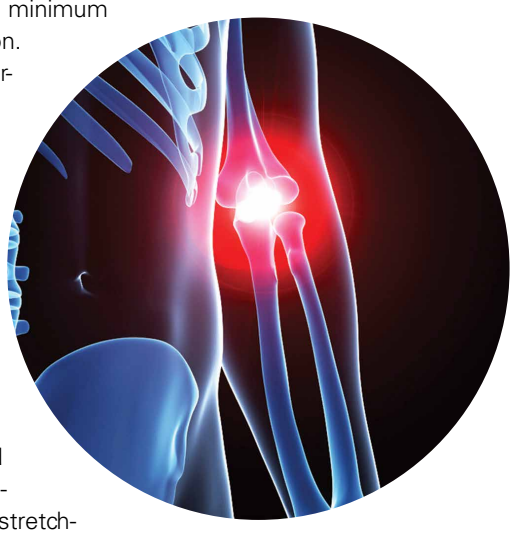
Institutional Review Board approval was obtained for this retrospective study of 44 baseball players treated with PRP injections for partial-thickness UCL tears.

Patients provided written informed consent. They were diagnosed with UCL insufficiency by physical examination, and findings were confirmed by magnetic resonance imaging (MRI). After diagnosis, all throwers underwent a trial of conservative treatment that included rest, activity modification, use of anti-inflammatory medication, and physical therapy followed by an attempt to return to throwing using an interval throwing program.

Study inclusion criteria were physical examinations and MRI results consistent with UCL insufficiency, and failure of the conservative treatment plan described.

Patients were injected using the Autologous Conditioned Plasma system (Arthrex). PRP solutions were prepared according to manufacturer guidelines. After the elbow was prepared sterilely, the UCL was injected at the location of the tear. Typically, 3 mL of PRP was injected into the elbow. Sixteen patients had 1 injection, 6 had 2, and 22 had 3. Repeat injections were considered for recalcitrant pain after 3 weeks.

After injection, patients used acetaminophen and ice for pain control. Anti-inflammatory medications were avoided for a minimum of 2 weeks after injection. Typical postinjection therapy protocol consisted of rest followed by progressive stretching and strengthening for about 4 to 6 weeks before the start of an interval throwing program. Although there is no well-defined postinjection recovery protocol, as a general rule rest was prescribed for the first 2 weeks, followed by a progressive stretching and strengthening program for the next month. Patients who were asymptomatic subjectively and clinically—negative moving valgus stress test, negative milking maneuver, no pain with valgus stress—were started on an interval throwing program.



Final follow-up involved a physical examination. Results were classified according to a modified version of the Conway Scale[12,24-26]: *excellent* (return to preinjury level of competition or performance), *good* (return to play at a lower level of competition or performance or, specifically for baseball players, ability to throw in daily batting practice), *fair* (able to play recreationally), and *poor* (unable to return to previous sport at any level).

By final follow-up, all patients had completed their postoperative rehabilitation protocol, and all had at least tried to return to their previous activities. No patients were lost to follow-up.

Results

Of the 44 baseball players, 6 were professional, 14 were in college, and 24 were in high school. There were 36 pitchers and 8 position players. Mean age was 17.3 years (range, 16-28 years). All patients were available for follow-up after injection (mean, 11 months). Fifteen of the 44 players had an excel-

lent outcome (34%), 17 had a good outcome, 2 had a fair outcome, and 10 had a poor outcome. After injection, 4 (67%) of the 6 professional baseball players returned to professional play. Five (36%) of the 14 college players had an excellent outcome, and 4 (17%) of the 24 high school players had an excellent outcome. Of the 8 position players, 4 had an excellent outcome, 3 had a good outcome, and 1 had a poor outcome.

Before treatment, all patients had medial-sided elbow pain over the UCL inhibiting their ability to throw. Mean duration of symptoms before injection was 8.8 months (range, 1-36 months). There was no correlation between symptom duration and any outcome measure. On MRI, 29 patients showed partial tears: 22 proximally based and 7 distally based. The other 15 patients had diffuse signal without partial tear. All 7 patients with distally based partial tears and 3 of the patients with proximally based partial tears had a poor outcome. Overall, there were 6 excellent, 7 good, and 2 fair outcomes in the partial-tear group. In the patients with diffuse signal without partial tear, there were 9 excellent and 10 good outcomes.

Mean time from injection to return to throwing was 5 weeks, and mean time to return to competition was 12 weeks (range, 5-24 weeks). The 1 player who returned at 5 weeks was a professional relief pitcher whose team was in the playoffs. He has now pitched for an additional 2 baseball seasons without elbow difficulty.

There were no injection-related complications.

Discussion

To our knowledge, this is the first report documenting successful PRP treatment of UCL insufficiency. In this study, 73% of players who had failed a course of conservative treatment had good to excellent outcomes with PRP injection.

Data on successful nonoperative treatment of UCL injuries are limited. Rettig and colleagues[1] treated 31 throwing athletes' UCL injuries with a supervised rehabilitation program. Treatment included rest, use of anti-inflammatory medication, progressive strengthening, and an interval throwing program. Only 41% of the athletes returned to their previous level of play, and it took, on average, 24.5 weeks. There was no significant difference in age or in duration or acuity of symptoms between those who returned to play and those whose conservative treatment failed.

Surgical reconstruction of UCL injuries has been very successful, with upward of 90% of athletes returning to previous level of play.[3,27] The procedure, however, is not without associated complications, including retear of the ligament, stiffness, ulnar nerve injury, and fracture.[27-29] In addition, even when successful, the procedure requires that athletes take 9 to 12 months to recover before returning to competition at their previous level.

Savoie and colleagues,[30] in their recent study on UCL repairs, highlighted an important fact that is often overlooked when reviewing the literature on UCL tears. Most of the literature on these injuries focuses on college and professional baseball players in whom ligament damage is often extensive, precluding repair. In contrast to prior reports, Savoie and colleagues[30] found excellent results in 93% of their young athletes who underwent UCL repair. It is possible that their results can be attributed to the fact that many of their athletes had tears isolated to one area of the ligament, as opposed to generalized ligament incompetence. Our improved results vis-à-vis other reports on conservative management may be attributable to the same phenomenon.

PRP has garnered much attention in the literature and media because of its potential to enhance healing of tendons and ligaments; in some cases, it can obviate the need for surgery. After failure of other nonoperative measures in 15 patients with elbow epicondylitis, Mishra and Pavelko[8] treated each patient with a single PRP injection. They prepared the PRP using the GPS III system (Biomet). At final follow-up, 93% improvement was seen. Clearly, their experiment had design flaws: It was nonblinded, and 3 of the 5 patients in the control group treated with bupivacaine injection withdrew from the experiment. Despite its shortcomings, their study became the impetus for several other studies.

A larger, double-blinded, randomized controlled trial comparing PRP and cortisone injections for lateral epicondylitis in 100 patients is under way, and preliminary results have been published.[9] A minimum of 6 months after injection, patients who received PRP showed more improvement in visual analog scale (VAS) pain scores and Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire scores. In another large, double-blinded, randomized controlled trial, patients with chronic lateral epicondylitis had significant improvements in VAS pain scores and DASH scores relative to patients injected with corticosteroids with a 2-year follow-up.[31] Similarly, Thanasas and colleagues[32] found significantly reduced VAS pain scores in patients injected with PRP versus autologous whole blood.

Another study demonstrated improved tendon morphology using ultrasound imaging 6 months after PRP injection.[33]

Contrary to these positive results, Krogh and colleagues[34] found that a single injection of PRP or glucocorticoid was not significantly superior to a saline injection for reducing pain and disability over a 3-month period in patients with lateral epicondylitis. Their study, however, had major flaws. Its original design called for a 12-month follow-up, but there was massive dropout in all 3 treatment arms, necessitating reporting of only 3-month data. In addition, 60% of the patients in the glucocorticoid group were not naïve to this treatment, so definitive conclusions about the efficacy of glucocorticoids could not be made.

In the present study, we successfully treated partial ligament tears with PRP injections. Sixty-seven percent of our baseball players returned to play at a mean of 4 months, much earlier than the 9 to 12 months typically required after ligament reconstruction. Many athletes, such as high school baseball players or aging veteran professional baseball players, do not have the luxury of 12 months for recovery. Therefore, this select group of patients clearly has a limited window of opportunity to return to play. In fact, these patients might be ideal candidates for PRP injections for UCL injuries. Return-to-play rates, however, differed significantly among professional players and nonprofessional players. The difference may be attributable to professional players' conditioning, quality of physical therapy, extrinsic motivation, and other intangible factors. Four (67%) of our 6 professional baseball players returned to professional play after injection, whereas only 36% of college players and 17% of high school players had excellent outcomes.

Limitations

The present study had several weaknesses, several of which are inherent to PRP studies conducted so far. It was not a prospective, randomized controlled trial. It is important to note that PRP treatment in diseased tissue may have some drawbacks, as its success depends on the ability of healing tissue to use concentrated growth factors and cytokines to proliferate.[35] Thus, a chronically injured ligament with depleted active cells may have a diminished response to PRP. Another limitation of this study is that we evaluated outcomes based on return to play using the Conway Scale, which is well reported but not validated. Despite the potential weaknesses of this outcome scale, it has become the benchmark for measuring the success of outcomes of UCL reconstruction. Furthermore, we did not measure patients' satisfaction with the treatment. Players who could not return to their preinjury level of play may have considered the treatment a failure regardless of their ability to continue throwing. Last, MRI was not repeated to document ligament healing. We did not routinely perform a second MRI because we thought it would not affect treatment. Several series have found a high incidence of abnormal signal in baseball players' UCLs. In this group of patients, the most important outcome is return to previous level of competition.

This study raised several questions. Is one PRP brand better than another? Should more than 1 injection be given? What is the ideal postinjection protocol? Clearly, larger, prospective, randomized controlled studies are needed to truly elucidate the potential role of PRP in the treatment algorithm for UCL injury. Nevertheless, in certain cases in which traditional conservative measures have failed and patients do not have the luxury of rehabilitating for 9 to 12 months after surgery, PRP may be a viable treatment option.

Conclusion

In this study, use of PRP in the treatment of UCL insufficiency produced outcomes much better than earlier reported outcomes of conservative treatment of these injuries. PRP injections may be particularly beneficial in young athletes who have sustained acute damage to an isolated part of the ligament and in athletes unwilling or unable to undergo the extended rehabilitation required after surgical reconstruction of the ligament.

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