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Role of platelet rich plasma in chronic tennis elbow

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Abstract

Introduction: Chronic tennis elbow is a common problem, for which current available treatments are often unsatisfactory. Biologic therapies, such as platelet rich plasma (PRP) injections, aimed at stimulating healing of degenerative tendons by releasing growth factors, have shown promise in vitro study but clinical research is limited. The objective of present study is to study the efficacy of platelet rich plasma in chronic tennis elbow, and to evaluate the outcomes of this recent modality of treatment for chronic tennis elbow.

Materials and Methods: Patients who were diagnosed with chronic tennis elbow and undergone conservative treatment for at least 3 months but not improved were included in the study after obtaining written informed consent. After preparation of PRP by centrifugation, the injection was given under ultrasonography (USG) guidance at the site of tendinopathy within 4 hours of preparation. The patients were evaluated by visual analogue score (VAS) and Mayo Elbow Performance Score (MEPS) at 4,8,12 weeks and 6 months and at 1 year.

Result: 30 patients fulfilling the inclusion criteria were included in the study and treated with PRP. Majority of them showed significant improvement in terms of VAS and MEPS scores as well as were able to return to work at 12 weeks of follow up.

Conclusion: Platelet-rich plasma (PRP) may represent a therapeutic option for chronic tennis elbow. Thus, future research should focus on identifying proper treatment time, optimal dosage and ideal PRP concentration.

Keywords: Platelet rich plasma, visual analogue score, mayo elbow performance score

Introduction

Lateral epicondylitis known as tennis elbow is a repetitive strain injury caused by repetitive overuse of the extensor muscles of the wrist. It is the most frequent type of myotendinosis occurring more specifically at the common extensor tendon that originates from the lateral epicondyle [1, 2]. The frequency of lateral epicondylitis is reported between 1 to 3% among normal non-athlete population [3]. Epicondylitis was initially believed to be an inflammatory process but in 1979, it was described as the disorganization of normal collagen architecture by invading fibroblasts in association with an immature vascular reparative response, which termed “angiofibroblastic hyperplasia” [1, 2]. It causes pain and functional impairment in daily activities [2, 3]. The treatment of this condition includes conservative therapy and surgical interventions [3, 4]. The effectiveness of oral non-steroidal anti-inflammatory agents, topical and injectable medications including corticosteroids and botulinum toxins, splinting, physical therapy, and iontophoresis has been evaluated in many studies [4]. However, these traditional therapies do not alter the tendon’s inherent poor healing properties secondary to poor vascularization [5, 6]. Given the inherent nature of the tendon, the treatment options including platelets rich plasma (PRP), autologous blood, and prolotherapy are aimed at inducing inflammation rather than suppressing it [7-9].

PRP is quite a good treatment used for chronic tendinitis [4]. PRP contain platelets, and these platelets have strong growth factors and granules that have critical role in the healing process of chronic injuries [7, 8]. Due to higher concentration of platelets in PRP than whole blood, it was shown to have greater effect in the repair process in treatment of chronic nonhealing tendinopathies including tennis elbow [4, 8, 9]. Therapeutic PRP should have a platelet concentration 3 to 6 times greater than that of whole blood (20000/mm³). The concentrations less than or greater than this amount may be ineffective or inversely lead to suppression of the healing process [4, 6, 7]. Some studies have shown that local injection of autologous whole blood has greater therapeutic effect than steroid injection in treating tennis elbow [5, 10, 11];

also there are studies showing the greater efficacy of local autologous PRP than corticosteroids in treating this disorder [4, 8]. However, only a few studies have been conducted to compare the efficacy of these two treatments. A comparative study of these 2 treatments was conducted by Thanasas *et al.* in 2011 in an effort to investigate the possible advantages of PRP versus autologous whole blood for the treatment of chronic tennis elbow. Six weeks after the therapy, PRP treatment seemed to be more effective than autologous blood in reducing pain [12]. However, this study and most of the other similar studies lacked objective evaluations of symptom improvements after whole blood or PRP injection. Considering the lack of a study of PRP injection objectively, the aim of the current study was designed to evaluate the effect of PRP injection in chronic tennis elbow which had not improved with conservative treatment.

Material and Methods

This was a prospective study undertaken in a tertiary care hospital where patients with chronic lateral epicondylar tendinopathy were included in the study after obtaining their informed consent. This study was undertaken from April 2015 to April 2016 after obtaining permission from Institutional Ethical Committee.

Chronic lateral epicondylitis is defined as lateral epicondylitis symptoms that last for more than 3 months [13]. But in this study Patient with symptoms typical of chronic tennis elbow who had taken drugs like paracetamol 500mg or ibuprofen 200mg thrice a day, activity modification in terms of avoiding lifting of heavy weight, rest and physiotherapy in terms of extracorporeal shock wave therapy for 3 months but pain not decreased in terms of VAS and MEPS or pain increased than before were included in this study. A detail history was obtained for evaluating the mode of trauma, visual analogue score, chronicity, physiotherapy, any injection taken previously etc. Detail clinical examination and x-rays were obtained to see any evidence of fracture. Laboratory investigations were carried out in all patients which include complete blood count (CBC), erythrocyte sedimentation rate (ESR), random blood sugar (RBS), radiograph of elbow and ultrasonography of local part before giving injection. Magnetic resonance imaging (MRI) was conducted in only 1 patient due to doubtful diagnosis by clinical examination. Blood count was done to see white cell counts to rule out infection, ESR was also done to rule out infection, RBS done to check for diabetes, radiographs done to rule out fracture and ultrasonography was done to see for the degenerative changes. The diagnosis was based on (1) pain over the lateral humeral epicondyle that may radiate distally to the forearm, (2) tenderness over lateral humeral epicondyle and (3) aggravated pain on gripping, lifting and resisted wrist and/or second or third finger extension. If these three features were present for more than 3 months with or without conservative treatment as mentioned above, then only patients were included in the study. Patients who were having

any skin pathology at the injection site, patients having symptoms of tennis elbow with less than 3 months of duration, patients who were on antiplatelet therapy like myocardial infarction, stroke, pregnancy, etc. and patients who were having more than one tendinopathies were excluded from the study.

After taking written consent from the patient, around 40 ml blood was withdrawn by venepuncture in acid citrate dextrose (ACD) tubes with help of scalp vein. Platelet count was checked in the sample. The sample was centrifuged in machine using a soft spin at 3000 rotation per minute. Supernatant plasma was then transferred to another sterile tube without containing any anticoagulant. Centrifuge this tube at a higher speed using a hard spin.

After that the lower 1/3rd was platelet rich plasma (PRP) and upper 2/3rd platelet poor plasma (PPP). At the bottom of the tube, platelet pellets were formed. Suspend the platelet pellets in a minimum quality of plasma after removing PPP and then gently shake the tube. The platelet count is checked and it should contain 3 to 5 times of platelet count from its baseline. This platelet rich plasma was injected within 4 hour of preparation under ultrasonography guidance at the site of pain with aseptic precautions. After giving platelet rich plasma injection, patients were given paracetamol 500mg thrice a day and arm sling for 4 weeks. Then patients were encouraged to return to work and for physiotherapy as soon as there was pain relief.

All the patients were followed up in OPD (outpatient department) at 4 weeks, 8 weeks, 3 months and 6 months and at 1 year. At every follow up, range of motion, visual analogue scale, Mayo elbow performance score and local complications were recorded along with the duration at which patient joined back to duty after PRP injection.

Results

Thirty patients [M=18, F=12] with chronic tendinopathies who gave the consent for platelet rich plasma injection, were included as study sample. The mean age of study group was 38 years for the male, while it was 40 years for the female. Sixty per cent of males and females belong to 31 - 40 years, 80% of males and females belong to 31 - 50 years.

Pain relief is considered when visual analogue scale of the patient decreased to at least 50% from preinjection visual analogue scale. If Visual Analogue Scale is less than 20 then the result is excellent; if VAS is between 20 to 49 then the result is good; if VAS is between 50 to 69 then the result is fair and if VAS is greater than 70 then the result is poor. 28 patients got excellent to good results with significant relief in pain; 1 patient had fair result whereas 1 patient had poor result with minimal relief in pain (Table 1). Most of the patients had pain relief at around 8 weeks after injection. Only 2 patients with tennis elbow had very less relief in pain at the end of 1 year.

Table 1: Distribution of patients as per vas

| VAS | Before injection | After 4 weeks of injection | After 8 weeks of injection | After 12 weeks of injection | After 6 months of injection | After 1 year of injection |
|---------|------------------|----------------------------|----------------------------|-----------------------------|-----------------------------|---------------------------|
| ≥ 70 | 26 | 20 | 04 | 02 | 01 | 01 |
| 50 - 69 | 03 | 07 | 12 | 06 | 01 | 01 |
| 20 - 49 | 01 | 03 | 14 | 10 | 04 | 02 |
| < 20 | 00 | 00 | 00 | 12 | 24 | 26 |
| Total | 30 | 30 | 30 | 30 | 30 | 30 |

Function of elbow was graded on the basis of Mayo elbow performance score as Excellent ≥ 90 points, Good: 75–89 points,

Fair: 60–74 points and Poor < 60 points. According to MEPS, most of the patients had good score at around 8 weeks of

injection. 96.6% of patients had excellent to good score at the end of 1 year follow up (Table 2). Only 1 patient had fair score at the end of 1 year.

Table 2: Distribution of patients as per MEP score

| MEPS score | Before injection | After 4 weeks of injection | After 8 weeks of injection | After 12 weeks of injection | After 6 months of injection | After 1 year of injection |
|------------|------------------|----------------------------|----------------------------|-----------------------------|-----------------------------|---------------------------|
| ≥ 90 | 01 | 04 | 09 | 21 | 25 | 27 |
| 75 - 89 | 02 | 08 | 17 | 08 | 04 | 02 |
| 60 - 74 | 18 | 13 | 03 | 01 | 01 | 01 |
| < 60 | 09 | 05 | 01 | 00 | 00 | 00 |
| Total | 30 | 30 | 30 | 30 | 30 | 30 |

It was found that quality of platelet count in platelet rich plasma had impact on the result. When the platelet count in platelet rich plasma injection was less than 3.5 times to the baseline level, 2 patients had fair to poor result out of 3 patients. When the platelet count in platelet rich plasma injection was between 3.5

to 5.5 times to the baseline level, significant pain relief was found in all patients. When the platelet count in platelet rich plasma injection is more than 5.5 times to the baseline level, all the patients have excellent result in chronic lateral epicondylar tendinopathy (Table 3).

Table 3: Quality of PRP Compared with Results

| Quality of PRP [increase in concentration compared to the baseline platelet count] | No. of Patients | Result according to VAS | Result according to MEPS |
|--|-----------------|-------------------------|--------------------------|
| < 3.5 | 03 | Excellent – 00 | Excellent – 00 |
| | | Good – 01 | Good – 02 |
| | | Fair – 01 | Fair – 01 |
| | | Poor – 01 | Poor – 00 |
| 3.5 - 5.5 | 22 | Excellent – 21 | Excellent – 22 |
| | | Good – 01 | Good – 00 |
| | | Fair – 00 | Fair – 00 |
| | | Poor – 00 | Poor – 00 |
| >5.5 | 05 | Excellent – 05 | Excellent – 05 |
| | | Good – 00 | Good – 00 |
| | | Fair – 00 | Fair – 00 |
| | | Poor – 00 | Poor – 00 |

Discussion

Elbow epicondylar tendinosis is a common problem with many types of available treatments. Quick relief from symptoms is important to patients and is economically advantageous. If neither rest nor simple treatment provides a satisfactory remedy, a patient may pursue several other options. The most commonly recommended treatment is physical therapy and analgesics. A recent meta-analysis of physical therapy, however, noted that there is insufficient evidence to conclude that it has any lasting value [14]. Corticosteroid injections have also been used for this problem, but it may result in subcutaneous atrophy and that intratendinous injection may lead to permanent adverse changes within the tendon. Despite these issues, corticosteroid is still widely used. Extracorporeal shock wave therapy is also used and has recently gained popularity. A recent randomized double-blind study, however, showed that this treatment is no better than placebo [15]. Biologic treatments in orthopaedics are just beginning to evolve. Platelet-rich plasma may also be helpful for wound healing. Platelet-rich plasma injections have also been used to treat recalcitrant plantar fasciitis and other chronic tendinopathies. Barrett and Erredge [16] reported a 78% success rate with 1-year follow-up. Of importance, no PRP-treated patient was worse after treatment, and there were no complications in this study. The current study was a prospective interventional study undertaken in a tertiary care hospital, in order to achieve the objective of the study. 30 patients having chronic lateral epicondylar tendinopathy were given platelet rich plasma injection at local site under ultrasound guidance. Mishra and Pavelko (2006) [3] treated 140 patients with chronic lateral epicondylitis by injection of platelet rich plasma and at

final follow up (mean 25.6 months; range 12 - 38 months) they reported 93% reduction in pain compared with before treatment. Hechtman KS, Uribe JW, Botto-van Demden A, Kiebzak GM (2011) [18] in a similar study using PRP, treated 31 patients with epicondylitis not responding to conservative treatment for 6 months. The overall success rate was 90% (28 of 31 elbows). Patient satisfaction improved from 5.1 ± 2.5 at 1 month to 9.1 ± 1.9 at last follow up. Peerbooms JC, Sluimer J, Bruijn DJ, Gosens T (2010) [19] compared the results of two groups of patients suffering from lateral epicondylitis. The first group ($n = 51$) treated by PRP injection and the second group ($n = 49$) treated by corticosteroid injection. The results showed 73% success rate in the PRP group compared to 51% success rate in the corticosteroid group after 1 year follow up. Thanasas C, Papadimitriou G, Charalambidis C, Paraskevopoulos I, Papanikolaou A (2011) [17] treated two groups of patients with lateral epicondylitis the first group included 14 patients treated by PRP injection and the second group included 14 patients treated by injection of autologous blood and concluded that PRP treatment is superior to autologous blood concerning short term results but no statistically significant difference in the elbow function at follow up. Creaney L, Wallace A, Curtis M, Conell D (2011) [20] compared the results of two groups of patients suffering from lateral epicondylitis. The first group ($n = 80$) treated by PRP injection and the second group ($n = 70$) treated by autologous blood injection. The results showed 66% success rate in the PRP group compared to 72% success rate in the autologous blood injection group after 6 months follow up. Gosens T, Peerbooms JC, van Laar W, den Ouden BL (2011) [21] compared the results of two groups of patients with chronic

lateral epicondylitis. The first group ($n = 51$) treated by leukocyte-enriched PRP injection and the second group ($n = 49$) treated by corticosteroid injection. Both groups significantly improved across the time. After 2 years follow up, the DASH scores of the corticosteroid group returned to baseline levels while those of PRP group significantly improved. Chaudhury S de lama, M Alder RS, Gultta LV, Skonieczki B, Moley P, Cordasco E *et al.*, (2012) [22] treated 6 patients who had a baseline ultrasound confirming tendinosis of the common extensor tendon. Patients received 3 ml PRP under sonographic control. Five patients were available for follow up and they gained improvement of tendon morphology rather than tendon vascularity at 6 months follow up. Gupta, S. K. Venkatesh, Bandari and Divya (2016) [23] observed highly significant differences between VAS and DASH (Disabilities of arm, shoulder and hand) before and after injection; 4 to 8 weeks after injection, 75% patients had excellent VAS score improvement (>50% reduction) and around 62% had reduction of DASH score (>50%). SH Lhee, JW Kim, JB Jeon and DY Lee (2016) [24] observed no significant improvement in DASH score at initial point, 3 months and 6 months after the treatment. But at 18 and 24 months after treatment, DASH score was better in PRP group than in physiotherapy, prolotherapy and extracorporeal shock wave therapy groups.

This current study is having 30 patients who are treated with PRP injection under USG guidance with 1 year follow up shows 93.33% of patients had good to excellent result in terms of VAS and 96.66% of patients had good to excellent result in terms of MEPS (Table 4).

Table 4: Distribution of patients as per result

| Result | VAS | MEPS |
|-----------|-----|------|
| Excellent | 26 | 27 |
| Good | 02 | 02 |
| Fair | 01 | 01 |
| Poor | 01 | 00 |
| Total | 30 | 30 |

The limitations of this study include lack of a randomized control group and the small number of patients. This study, however, was designed only as a pilot investigation. A double-blind, placebo-controlled, prospective multicenter trial has now been approved, which should help better evaluate PRP as a treatment for chronic tennis elbow. This report outlines the in vivo human investigation of platelet rich plasma as a treatment for chronic severe elbow tendinosis in patients who have failed conservative treatment.

Conclusion

The findings of this study show that platelet rich plasma injection under ultrasound guidance is an effective mode of treatment for patients with chronic tennis elbow. In this study, 28 patients were having significant pain relief at 1 year. This suggests that platelet rich plasma injection takes time to act and this will result in gradual decrease in pain and symptoms. Platelet rich plasma is very effective in treatment of chronic tennis elbow. One should consider this treatment before going for surgical treatment for chronic tennis elbow. Incidentally we found that when the platelet count in PRP injection is less than 3.5 times to the baseline, the result was less than excellent. The patients with platelet count less than 3.5 times to the baseline in PRP were only 3, so it may not be generalised to the population. But when the platelet count in PRP was more than 3.5 times to the baseline, then the chance of good result increases.

The data suggest PRP may be an alternative to surgery in patients with chronic tennis elbow. In the present investigation, the PRP-treated patients demonstrated significant improvement with a single injection that was sustained over time with no reported complications.

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