



ISSN: 2395-6429

A COMPARATIVE ANALYSIS OF FUNCTIONAL OUTCOME AND PAIN IN TENNIS ELBOW PATIENTS TREATED WITH AUTOLOGOUS BLOOD INJECTION AND PLATELET RICH PLASMA INJECTION

*J.Nirmalraja¹., Dhanpal Singh²., B.Krishnaswamy³.,
P.S Balamurugavel⁴ and A.Manikandarajan⁵

*^{1,2,4,5} Department of Orthopaedics, Rajah Muthiah Medical College and Hospital, Annamalai University, Chidambaram, Tamilnadu, India-608 002

³Department of Pathology, Rajah Muthiah Medical College and Hospital, Annamalai University, Chidambaram, Tamilnadu, India-608 002

ARTICLE INFO

Article History:

Received 9th July, 2017

Received in revised form 5th

August, 2017

Accepted 25th September, 2017

Published online 28th October, 2017

Key words:

Tennis elbow, Platelet rich plasma, Autologous blood, PRTEE, Manual algometer

ABSTRACT

Introduction: Lateral epicondylitis (Tennis elbow) is myotendinosis occurring at common extensor origin due to repetitive overuse of extensor muscles of the wrist. New treatment options include PRP and autologous blood injection. This study is designed to compare these two novel methods of treatment of lateral epicondylitis.

Aim- The aim of this study is to compare the functional outcome and pain in patients with tennis elbow treated with autologous blood injection and platelet rich plasma injection.

Materials & Methods- Patients with clinical signs and symptoms of chronic lateral epicondylitis during June 2016 to October 2017 attending the Orthopaedics out patient department of RMMCH, Chidambaram were evaluated. Prospective comparative study was done with Platelet rich plasma injection and autologous blood injection for tennis elbow patients and were followed up for one year.

Results- 50 patients with Tennis elbow were randomized into two groups and were treated with platelet rich plasma injection or autologous blood injection. They were followed up for one year with PRTEE (Patient rated tennis elbow evaluation scoring) and manual algometer. In Both groups they had improvement in symptoms and significant improvement was noted in PRP population than autologous blood group with peak effect at six month of follow up.

Conclusion- PRP and autologous whole blood injections are both effective to treat chronic lateral epicondylitis. PRP is superior at six months of follow up. After which the beneficial effects seems to have started diminishing. The patients treated with PRP has shown better pain relief and improved function. Surely PRP will change the way orthopaedicians are treating tendinopathies in the future. However, further studies with longer follow up and with repeat injections are suggested to get definite conclusion.

Copyright © 2017 J.Nirmalraja et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Lateral epicondylitis, also known as tennis elbow, was first described by Rungue in 1873. Lateral elbow epicondylitis ("tennis elbow") is a common clinical entity affecting 1% to 3% of the population. Lateral epicondylitis result from cumulative microtrauma due to repetitive wrist extension and alternating forearm supination and pronation^{1,2}. The cause of the disease is a combination of mechanical overloading and abnormal microvascular responses. Nirschl and Petrone³ attributed the cause to microscopic tearing with formation of reparative tissue (ie, angiofibroblastic hyperplasia) in the origin of the extensor carpi radialis brevis muscle. Treatment

options include rest, nonsteroidal anti-inflammatory medication, physical therapy, extracorporeal shock wave therapy, ultrasound therapy, botulinum injection, and corticosteroid (CS) injection. These method of treatments do not alter the tendon inherent poor healing properties. New treatment options include PRP and autologous blood Injection, which promotes inflammation thereby accelerating the tendon healing. The concept of delivering humoral mediators in an effort to promote normal tendon healing by locally injecting autologous blood was first reported in 2003. Injection of biological agents achieves a favourable long-term clinical outcome. Since first being introduced by Ferrari *et al*⁴. in 1987 following an open heart surgery, platelet rich plasma has

swiftly gained recognition as a versatile, biocompatible and cost-effective "tissue engineering" modality, stimulating therapeutic uses in a variety of medical fields, including orthopedics, dentistry, ENT, neurosurgery, ophthalmology, urology, wound healing, as well as cosmetic, cardiothoracic and maxillofacial surgery.

Aims of the Study

The aim of this study is to compare the functional outcome and pain in patients with tennis elbow treated with autologous blood injection versus platelet rich plasma injection using Patient rated tennis elbow evaluation scoring system and pressure pain threshold using algometer

Principle

Lateral epicondylitis (Tennis elbow) is myotendinosis occurring at common extensor origin due to repetitive overuse of extensor muscles of wrist. The current consensus is that tennis elbow is initiated as a microtear within origin of extensor carpiradialis brevis, microscopically which shows immature vascular reparative process. The traditional method of treatments like NSAIDs, Cortisone injection ,physical therapy ,etc do not alter the tendon inherent poor healing properties. New treatment options include PRP and autologous blood injection. This study was designed to compare the efficacy of autologous blood or platelet rich plasma injection in the treatment of tennis elbow.

MATERIALS AND METHODS

All patients with clinical signs and symptoms of chronic lateral epicondylitis during June 2016 to October 2017 attending the Orthopaedics out patient department of RMMCH, Chidambaram were evaluated.

Inclusion Criterias

Criteria for inclusion in the study were clinically diagnosed lateral epicondylitis (based on symptoms, site of tenderness, and pain elicited with resisted active extension of the wrist in pronation); with duration of symptoms more than 2 weeks and pain severity with minimum score of 5 (based on 10 scale Visual Analogue Score (VAS)).

Exclusion Criteria

Local infection at the site of the injection

- History of trauma.
- Platelet dysfunction syndrome, or any other coagulopathies
- Recent use of corticosteroids during last 2 weeks.

METHODOLOGY

Ethical Consideration

All patients were given a written consent explaining to them the procedure of study and that it posed no harm to their health. They were given access to the physician of the study in case of any need to contact him if any adverse reaction arises due to the injection.

Randomization

The patients with tennis elbow (n=50) attending the out patient department were included in the study. Every odd numbered patient was placed in group A and every even numbered patient was placed in Group B.

Intervention

Group A: The patients in group one were given single injection of autologous blood of about 2 ml into point of maximal tenderness at lateral epicondyle under strict aseptic precautions.

Group B: For the patients in this group, about 5 ml of autologous blood was obtained by venepuncture. In the blood bank, the blood was centrifuged in a cooling centrifuge at 22 degrees Celsius at 1800 RPM for a period of about 10 mins to yield Platelet rich plasma. The patients were given single injection of autologous platelet rich plasma of about 1 ml into point of maximal tenderness at lateral epicondyle under strict aseptic precautions.

All patients in both groups were observed for about 15 minutes, then sent home. Only paracetamol and T. Cefixime 200 mg BD for 3 days were prescribed .Both group were advised to avoid strenuous work. And they were taught stretching exercises to start from 3rd day. The patients were followed up on the first week, 1st month, 2nd month, 3rd month , six months and one year using PRTEE scoring and Manual Algometer.



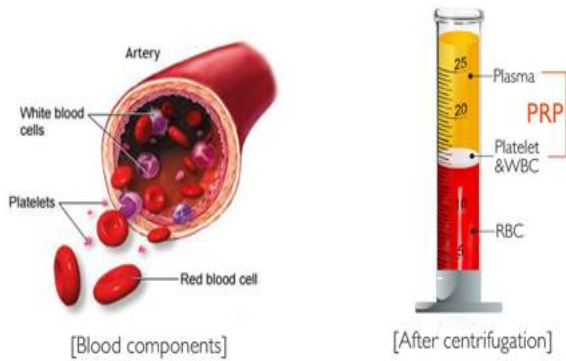
Manual algometer



Cooling centrifuge

RESULTS

Our study included 50 tennis elbow patients not amenable to conservative means of treatments for one month. Autologous blood injection was given in 25 patients and platelet rich plasma was given in 25 patients after randomization. The mean age group of patients in autologous blood injection was 35.96 years (23-50) and in platelet rich plasma group was 37.04 years

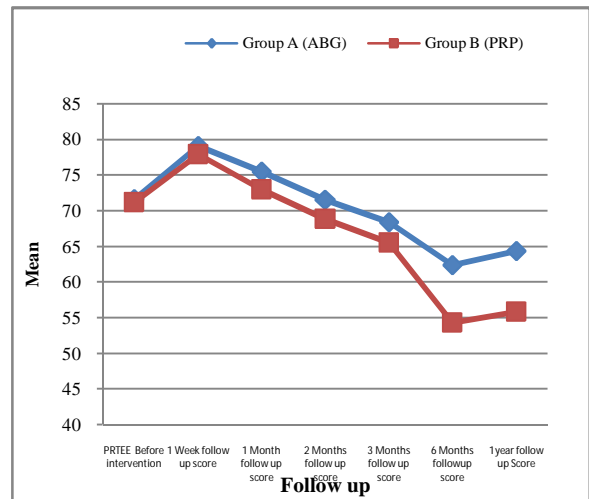


Platelet rich Plasma

(25-50).The age group 31 to 40 years dominates the series accounting for 44 % among autologous blood injection group and 44 % of platelet rich plasma group. Among 25 patients in autologous blood group, 15 patients (60 %) were male and among 25 patients in platelet rich plasma group 16 patients (64 %) were male. Hence in our study male population predominated the study group constituting 62 % of total study population. The right elbow constitutes 58 % overall. Dominant extremity is most commonly involved in tennis elbow as per our study. In our study group 28 % (n=14) are coolie and 26 % (n=13) are housewife by occupation overall. The next occupation in order is mason, 4 % (n=8).The mean pre intervention PRTEE score in autologous blood group is 71.60 whereas the mean pre intervention PRTEE score in platelet rich plasma group is 71.16 with a P value of 0.797 which is **statistically insignificant**, hence the two groups were comparable. At the 1st week of follow up the mean PRTEE score in autologous blood group had increased from 71.60 to 79.04. And very similarly the mean PRTEE score in platelet rich plasma group increased from 71.16 to 77.88 .

Thus the patient actually deteriorated at the 1st week, which can be attributed to the inflammation induced by these injected products. However from the first month of follow up, the score in both groups has started decreasing indicating improvement in both groups. The p value on comparing the PRTEE score in both groups at one week, 1 month, 2nd month and 3rd month follow up are 0.120; 0.141 and 0.137, which is statically insignificant (P>0.05) .However at the 6th month of follow up, the mean PRTEE score in autologous blood group was 62.36 and in platelet rich plasma group was 54.32 with a P value of 0.006 which is statically significant (P<0.05). Thus at our six months of follow up the platelet rich plasma group has shown significant improvement in PRTEE score when compared to autologous blood group. At the one year follow up we can see that both groups has stopped showing any further improvement in score.

Thus the line diagram shows a significant improvement in PRTEE score of platelet rich plasma group when compared to autologous blood group. The peak effect of platelet rich plasma is seen at the 6th month .The improvement in PRP group is 24% when compared to 13% improvement in autologous blood group at six months of follow up. But the effect seems to have reached a plateau from then on which is evident from our follow up score at one year of age.



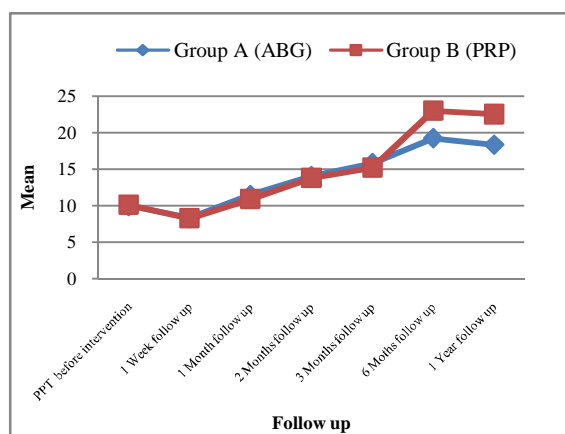
Pain Pressure Threshold

The mean pre intervention PPT measured by manual algometer in autologous blood group is 9.96 whereas the mean pre intervention PPT measured by manual algometer in platelet rich plasma group is 10.08 with a P value of 0.735 which is **statistically insignificant**, hence the two groups were comparable in account of the pain pressure threshold.

At the 1st week of follow up the mean PPT in autologous blood group had increased from 9.96 to 8.32. And very similarly the mean PPT in platelet rich plasma group increased from 10.08 to 8.28. Thus the patient actually deteriorated at the 1st week, which can be attributed to the inflammation induced by these injected products as suggested beforehand. However from the first month of follow up, the score in both groups has started decreasing indicating improvement in both groups. The p value on comparing the PPT score in both groups at one week, 1 month, 2nd month and 3rd month follow up are 0.239 ; 0.575 and 0.306 which are statically insignificant (P>0.05) .

However at the 6th month of follow up, the mean PPT in autologous blood group was 19.20 and in platelet rich plasma group was 22.96 with a P value of 0.00 which is statically significant (P<0.05). Thus at our six months of follow up the platelet rich plasma group has shown significant improvement in PPT when compared to autologous blood group similar to our findings in PRTEE score. At the one year follow up we can see that both groups has stopped showing any further improvement in PPT score. At six months of follow up, patients who received platelet rich plasma injection had shown 128% increase in mean pain pressure threshold when compared to those who received autologous blood group who showed only 93% increase in mean pain pressure threshold. Thus the peak effect of PRP was evident at 6 months and after that the beneficial effects of PRP seems to have reached a plateau

Pain relief was achieved in eighteen patients (72%) in autologous blood group. Seven patients had residual pain (28%). One patient had weakness of wrist extension. No cases of postoperative infection were noted. Pain relief was achieved in twenty one patients (84%) in platelet rich plasma group. Four patients had residual pain (16%) and they were not satisfied with the treatment they had received. One of the patient had mild post – injection superficial infection which subsided with oral wide-spectrum antibiotics.



DISCUSSION

Tennis elbow is caused due to microtear in the origin of extensor carpiradialis brevis due to repetitive wrist extension. There is actually degeneration in the tendon with defective reparative process in the form of angiofibroblastic hyperplasia. Our two interventions are aimed at bringing humoral mediators to the site of pathology and reversing this degenerative process in the form of promoting controlled inflammation and thereby accelerating healing.

In the past few years, clinical studies of testing platelet rich plasma^{5,6,7} and autologous blood^{8,9} have been published for the treatment of tennis elbow, both with promising results. Our study strongly favours platelet rich plasma over autologous blood in treatment of tennis elbow. The peak beneficial effects is evident at sixth month. The use of PRP is a proactive therapeutic option which jumpstarts the healing process, which contains several different growth factors and other cytokines that stimulate healing of bone and soft tissue.^{10,11} Klein *et al.*¹² supported this thought with *in vitro* data, reporting transforming growth factor beta significantly increases Type I collagen production in tendon sheath fibroblasts. Peerbooms *et al.*¹³ compared the application of PRP with corticosteroid injection in the treatment of lateral epicondylitis in a population of 100 patients, finding significantly improved outcomes in the PRP group with regard to pain and function, which was comparable to our study.

Peerbooms also highlighted that initial benefits of corticosteroid injections gradually declined, whereas PRP patients progressively improved which is also much evident in our study upto a follow up of six months after which the beneficial effects seem to have started diminishing. In the results published by Mishra and Pavelko⁶ who also demonstrated a significant improvement in pain and elbow scores after PRP injection for chronic elbow tendinosis compared with a control group treated with bupivacaine/epinephrine injection. After 4 weeks, PRP-treated patients reported a mean 46% improvement in pain and 42% improvement in Mayo elbow score compared with a 17% and 20% improvement, respectively, in the control group. These improvements were maintained through 25 weeks at the time of publication. This study is similar to our study where the patients receiving platelet rich plasma had shown significant improvement in pain and functionality at 24 weeks. In our study PRP group had showed 24 % improvement in PRTEE score when compared to 13 % in autologous blood group. At final follow-up (mean, 25.6 months), patients reported 93% reduction in pain, while in our study the pain pressure

threshold has improved in PRP group by a staggering 128% at the six months of follow up. Our study is supported by Mishra *et al* in a recent study in the *American Journal of Sports Medicine*, who evaluated 140 patients with chronic epicondylar elbow pain. Of those patients, 20 met the study criteria and were surgical candidates who had failed conservative treatments. In total, 15 were treated with one PRP injection and five were controls with local anesthetic. The treatment group noted 60% improvement at 8 weeks, 81% at 6 months, and 93% at final follow up at 12–38 months. Of note, there were no adverse effects or complications. Additionally there was a 94% return to sporting activities and a 99% return to daily activities in our study the peak beneficial effects of PRP were noted at six months much similar to our study.

In a study by Edwards and Calandrucio⁹ *et al* in 2003 they demonstrated that 22 of 28 patients (79%) with refractory chronic epicondylitis were completely pain free following autologous blood injection therapy. This study strongly supports our study where we had documented improvements in symptoms in 72% of the population who received autologous blood group. In support to our study we have a RCT conducted by Thanasis *et al.*¹⁴ in Greece. In this RCT he compared 14 patients treated with a single injection of PRP and a homogenous group treated by a single injection of autologous whole blood. Visual Analog Scale (VAS) for pain and the Liverpool elbow score were collected up to 6 months after treatment. No statistically significant differences were shown in Liverpool elbow score, while VAS was statistically lower for PRP group only at 6 weeks. In our study we have shown pain pressure threshold to be significantly improved ($P= 0.00$) in PRP group at six months of follow up.

In a study conducted in Meerut, India, Gyaneshwar Tonk *et al* studied 81 patients for a period of 2 years and showed that Low-level laser therapy is better in the short term period, but on long term followup injection PRP therapy is better than laser therapy in lateral epicondylitis. The mean age in our study was 36.5 years however in the study by gyaneshwar the mean age was 40.45 years. This study was also similar to our study in stating that the males were more commonly involved and dominant hand was mostly involved in tennis elbow. But the major difference in this study was that this study had a longer duration of follow of two years when compared to one year in our study. In a study conducted in Osmania medical college, Telangana by Sundeep Kund *et al* studied 50 patients for a period of 2 years and showed that Treatment with PRP holds promising results with minimal risk for the treatment of Tennis elbow. This has the same number of population studied. But this study has a follow up of about 2 years. And this study has followed a different method of PRP preparation than ours.

However our study is strongly opposed by a double blind RCT conducted by Krogh *et al.*¹⁵ in 2013. Sixty patients with evidence of chronic Lateral Epicondylitis (LE) were randomized to three groups: injection of PRP, saline, or glucocorticoid. After 3 months, patients were evaluated using the Patient-Rated Tennis Elbow Evaluation (PRTEE) questionnaire. The results showed no superiority of PRP or glucocorticoid compared to saline in lowering pain level. In contrast our study has clearly showed PRP to be more beneficial when compared to autologous blood injection at six months of follow up.

Similar to above study, our study is not supported by RCT conducted by Creaney *et al*¹⁶. Creaney had compared autologous whole blood injection to PRP. Seventy patients received the autologous blood, while eighty the PRP injection. At 6 months the PRTEE did not show any statistical difference. But in our study, PRTEE score at six months of follow up had shown significant improvement when compared to autologous blood group.

The limitation in our study is the small sample size and the short follow up period. Since the peak effect is evident only at sixth month of follow up, further studies are needed with repeated injections and much longer duration of follow up. In our study the lateral epicondylitis was diagnosed only clinically and not by any other diagnostic means such as ultra sonogram. Also there was no definitive protocol of platelet rich plasma preparation available till date and in our study their was no proper means of measuring the baseline increase in platelet count. The injection in our patients was not done under Ultra sonogram guidance. Also the patients in our study could not be blinded regarding the treatment they had received.

CONCLUSION

Treatment of lateral elbow epicondylitis is a real challenge to orthopaedicians with lots of treatment options, but none providing promising results. Newer treatment like autologous blood and platelet rich plasma has shown a promising future in treatment of tennis elbow. Among the two the platelet rich plasma has emerged as the clear winner in treatment of tennis elbow in our study. The patients treated with PRP has shown better pain relief and improved function, however it is interesting to note that the effect seems to have reached a plateau at six months of follow up. This has led us to emphasis on the need of repeat injection of platelet rich plasma every six months in the treatment of tennis elbow. Surely PRP will change the way orthopaedicians are treating tendinopathies in the future.

Bibliography

1. Cyriax JH. The pathology and treatment of tennis elbow. *J Bone Joint Surg* 1936; 18A: 921-40.
2. Coonrad RW, Hooper WR. Tennis elbow: Its course, natural history, conservative and surgical management. *J Bone Joint Surg Am* 1973; 55:1177-82
3. Nirschl RP, Pettrone FA. Tennis elbow: the surgical treatment of lateral epicondylitis. *J Bone Joint Surg Am*. 1979; 61:832-839.
4. Ferrari M, *et al*. A new technique for hemodilution, preparation of autologous platelet-rich plasma and intra-operative blood salvage in cardiac surgery. *Int J Artif Organs*. 1987;10:47-50

5. Mishra A, Collado H, Fredericson M. Platelet-rich plasma compared with corticosteroid injection for chronic lateral elbow tendinosis. *PMR*. 2009; 1(4):366-370.
6. Mishra A, Pavelko T. Treatment of chronic elbow tendinosis with buffered platelet-rich plasma. *Am J Sports Med*. 2006; 10(10):1-5.
7. Mishra A, Pavelko T. Treatment of chronic elbow tendinosis with buffered platelet-rich plasma. *Am J Sports Med*. 2006; 34:1774-1778.
8. Connell DA, Ali KE, Ahmad M, *et al*. Ultrasound-guided autologous blood injection for tennis elbow. *Skeletal Radiol*. 2006; 35(6):371-377.
9. Edwards SG, Calandruccio JH. Autologous blood injections for refractory lateral epicondylitis. *J Hand Surg Am*. 2003; 28(2):272-278.
10. Landesberg R, Roy M, Glickman RS. Quantification of growth factor levels using a simplified method of platelet-rich plasma gel preparation. *J Oral Maxillofac Surg* 2000; 58:297-300.
11. Smidt N, van der Windt DA, Assendelft WJ, Devillé WL, Korthals-de Bos IB, Bouter LM. Corticosteroid injections, physiotherapy, or a wait-and-see policy for lateral epicondylitis: A randomised controlled trial. *Lancet* 2002; 359:657-62.
12. Klein MB, Yalamanchi N, Pham H, Longaker MT, Chang J. Flexor tendon healing *in vitro*: Effects of TGF-beta on tendon cell collagen production. *J Hand Surg Am* 2002; 27:615-20.
13. Peerbooms JC, Sluimer J, Bruijn DJ, *et al*. Platelet-rich plasma versus corticosteroid injection with a 1-year follow-up. *Am J Sports Med*. 2010; 38:255-262.
14. Thanasas C, Papadimitriou G, Charalambidis C, Paraskevopoulos I, Papanikolaou A. Platelet-rich plasma versus autologous whole blood for the treatment of chronic lateral elbow epicondylitis: a randomized controlled clinical trial. *Am J Sports Med*. 2011;39 (10) :2130-4.
15. Kim E, Lee JH. Autologous platelet-rich plasma versus dextrose prolotherapy for the treatment of chronic recalcitrant plantar fasciitis. *PM & R J Injury Funct Rehabil*. 2014;6(2):152-8.
16. Creaney L, Wallace A, Curtis M, Connell D. Growth factor based therapies provide additional benefit beyond physical therapy in resistant elbow tendinopathy: a prospective, single blind, randomised trial of autologous blood injections versus platelet rich plasma injections. *British Journal of Sports Medicine*. 2011;45 (12):966-971.
