Section: Orthopaedic Surgery

Original Research Article

THE EFFICACY OF PLATELET RICH PLASMA (PRP) IN TREATING ACUTE, SUBACUTE AND CHRONIC MUSCULO-SKELETAL DISORDERS: A PROSPECTIVE STUDY

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Abstract

Background: PRP is an autologous bioactive connective tissue product, which is therapeutically safe, easy to prepare, a minimally invasive procedure and can be effectively done as a Day Care-Procedure with affordable cost. The Clinico-Functional benefit ratios, are moderate to excellent in a variety of Orthopaedic Maladies, top ranking among which are Osteoarthritis Knees, Enthesopathies and Sport related tendinous and ligamentous injuries. The tissue of damage can be targeted more accurately by either using MSK USG or C-arm guidance. Depending on the Clinico-Functional benefits accrued, if required they are repeated, upto 3 sittings, at monthly intervals. **Materials and Methods:** A total of 300 patients with Enthesopathies Grade I to Grade III osteoarthritis and various Sports related tendinous and ligamentous injuries were included in the study. PRP was infiltrated in the affected locale either with USG or C- Arm. Outcomes were evaluated 5 months after the treatment using visual analogue scale and WOMAC score. **Results:** Mean(SD) age of the patients was 38.2±11.1years. There were144 (48%) female and 156 (52%) male patients. The total sample size was 300 patients with a minimum of 5 months of follow-up. The majority of our cases were as follows: a. Enthesopathies 55.3% (n=166), b. OA Knees 36% (n=108), c. Sports related injuries 5.7% (n=17), d. PN Entrapment 3% (n=9). **Conclusion:** Platelet rich plasma is both safe and effective in treating Enthesopathies and osteoarthritis (OA). These regenerative and reparative abilities of PRP are attributed to various growth factors and potential proteins. They are affordable and can be safely carried out as a Day-Care-Procedure.

INTRODUCTION

Enthesopathies refer to the progressive deterioration due to stress which is repetitive in nature causing inflammatory degenerative changes, of the location where a tendon or a ligament connects to a bone.[1] This disease has the potential to impact various anatomical locations inside the body of an individual. Changes in the site of bonding of the wrist extensors or flexors with the humeral epicondyles,[2] Achilles tendon, patellar tendon, suprascapular tendon, as well as plantar fascia are among the most constantly encountered and accurately documented.[3] Patients commonly report experiencing localized pain and experiencing restrictions in their ability to engage in sports, employment, and daily activities, due to painful stiffness of the adjoining joints.[4] The etiology of the condition remains elusive. Nevertheless, the prevailing concept, posits that micro-injuries accumulate, due to repetitive overloads, that surpasses the body's compensatory ability.[5] The shift in the prevailing belief, regarding the inflammatory character of this disease, can be attributed to a multitude of histological investigations, that revealed the presence of disarranged tissue and neo-vessels throughout the affected tendon or ligaments, while exhibiting, a limited presence of inflammatory cells. Sometimes there can be calcifications.[6] Sometimes, these

enthesopathies lead to a state of chronicity, where surgical interventions become inevitable.[7]

Numerous therapeutic approaches have been suggested in response to the absence of efficacious therapy, with autologous Platelet-Rich Plasma (PRP) emerging, as a highly promising minimally interventionl therapeutic modality.[8] In this therapeutic protocol, the blood of the patient is obtained and subjected to centrifugation in order to separate the plasma component, that is abundant in platelets 3 to 5x of the baseline.[9] Subsequently, the plasma is introduced into the implicated tissue, commonly through localized inter-lesional injection. Platelet β-granules are known to possess substantial quantities of cytokines, that play a crucial role in the process of tissue regeneration.[10] Platelet-rich plasma (PRP) with a platelet concentration exceeding the baseline by 3 to 5 times is anticipated to exhibit, a notably elevated concentration, of crucial cytokines, chemokines, and growth factors.[11] Multiple in-vitro investigations, have demonstrated that these biologically active constituents. have a very crucial function, in tissue regeneration, by promoting cell growth, movement, differentiation, and the formation of neo blood vessels leading to tissue repair.[12]

The infusion of platelet-rich plasma (PRP), tends to significantly transform, the management of injuries including chronic degenerative conditions such as enthesopathy, by expediting the natural tissue healing processes.[13] PRP treatment is also applicable to other disorders characterized by the disruption of the normal equilibrium between anabolic as well as catabolic processes.[14] Several disorders, such as bone non-unions, bone de-vascularisation, difficult-to-heal injuries, osteoarthritis, and various sports injuries, have been associated with favorable clinical results.[15]

Osteoarthritis (OA) is the most prevalent kind of arthritis, prevalence estimated at around 30.5% among the adult demographic.[16] Osteoarthritis of the knee is a significant health problem due to its prevalence as the most commonly afflicted joint.[17] Non-pharmacological interventions for individuals experiencing symptomatic osteoarthritis (OA), typically commence with patient education including self-care, of risk factors associated with OA, physical exercise, weight reduction, physical therapy, as well as the utilization of orthotic devices.[18] PRP has been identified as a promising therapeutic approach, for those afflicted with osteoarthritis (OA).[19,20]

Aim of the study

The objective of this study, is to analyze the Clinico-Functional outcomes resulting from the administration of Autologous Platelet-Rich Plasma (PRP) injections for Musculo-Skeletal disorders of acute, sub-acute or chronic nature.

MATERIALS AND METHODS

Study design and participants

This is a prospective interventional study done in the Department of Orthopaedics in Trichy SRM MCH & RC from August 2023 to October 2023, with minimum follow-up till March 2024. Study protocol was approved by the institutional ethical committee via (Ref No.786/067). Male and female patients, above 18 years and below 57 years were included in the study. The study included patients reporting within 2 weeks of Sports related injury or at-least without relief from conservative measures for 6 weeks for Enthesopathies, Grade I to Grade III osteoarthritis in the knees, hip impingement syndrome, shoulder impingement syndrome, triangular fibrocartilage complex injuries, peripheral nerve entrapment, medial or lateral epicondylitis, retrocalcaneal bursitis, plantar fasciitis, Dupuytrens contracture, fibromyalgia, trigger finger, trigger thumb, and costochondritis-Teitze syndrome. Patients with previously infected joint, open ligament or muscular injury, immuno-compromised individual on long term steroid therapy, abnormally low platelet count, anaemia, cancer or any concurrent systemic infections, were excluded from the study.

Recruitment

Patients coming to Orthopaedics OPD with musculoskeleteal ultrasound / radiograph evidenced Enthesopathies and arthritis of non-weight bearing or weight bearing joints Sports-Injuries, were screened and eligible participants were recruited. Informed written consent was obtained from all patients after explaining the benefits and safety of the study, as it involved only autologous biological connective tissue transfer.

Intervention

A total of 300 patients, were recruited for the study, in adherence to our inclusion criteria. With aseptic precautionary protocols, a total volume of 30 to 40 ml of whole blood was obtained from the patient's antecubital vein using 8.5 ml of anticoagulant Citrate-Dextrose-Solution tubes(ACD) tubes. The PRP technique was employed to generate platelet-rich plasma. A smooth spin at a speed of 3000rpm/min, was employed for a duration of 3 minutes, in order to centrifuge the blood (Figure 1). The procedure was carried out in the OT with all aseptic precautions. The affected area or zone was targeted using C-Arm or USG and infiltrated with Platelet Rich Plasma (Figure 2, 3). It was repeated upto a maximum of 3 sittings at 4 weeks interval, depending upon the Clinic- Functional response.

Outcomes and measures

Outcomes were evaluated at the end of 5 months using visual analogue scale, quality of life questionnaire, activities of daily living or through composite questionnaire, prepared for enthesopathies and for Knee OA by WOMAC Scoring Index.

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Statistical Analysis

Statistical analysis was done using IBM SPSS software for windows, version 26.0., IBM Corp., Chicago, IL. Demographic data were analysed and given as descriptive statistics which were reported as mean (SD) for continuous variables, frequencies (%) for categorical variables. Visual analogue score and other questionnaires values before treatment and after 5 months were analysed using student T test. P value less than 0.05 was taken as statistically significant.

RESULTS

Study recruitment

A total of 412 patients were registered for screening. 66 (16%) patients were excluded based on the exclusion criteria. 46 (11.16%) patients did not give consent and were excluded. A total of 300 patients meeting the inclusion criteria participated in the study.

Demographic baseline characteristics

The mean (SD) age of patients was 38.2 ± 11.1 years. There were 144 (48%) females and 156 (52%) males. The demographic baseline characteristics of the patients are summarized in Table 1. Thus there was an almost equitable number of cases of both the sex, with no preponderance.

Pain visual analogue score

Pain VAS was statistically lower following PRP injection in 4 weeks ($p<0.0001$), 8 weeks ($p<0.0001$), 12 weeks ($p<0.0001$), 16 weeks ($p<0.0001$) and 20 weeks ($p<0.0001$). The mean (SD) of pain VAS is given in Table 2.

Osteoarthritis knee

Among osteoarthritis knee patients, mean (SD) age was 52.9 (2.5). Among them, pain VAS was statistically lower following PRP injection in 4 weeks ($p<0.0001$), 8 weeks ($p<0.0001$), 12 weeks ($p<0.0001$), 16 weeks ($p<0.0001$) and 20 weeks ($p<0.0001$). WOMAC score was significantly better following PRP injection in 4 weeks ($p<0.0001$), 8 weeks ($p<0.0001$), 12 weeks ($p<0.0001$), 16 weeks ($p<0.0001$) and 20 weeks ($p<0.0001$). The characteristics of patients with osteoarthritis are given in Table 3.

Table 1: Demographic baseline characteristic of 300 patients

S No	Pain VAS	Mean	SD	95% CI		P - value
				Lower bound (α=2.5%)	Upper bound (α=97.5%)	
1	Before treatment	7.45	1.13	7.33	7.58	
2	4 weeks	5.78	1.52	5.61	5.95	<0.0001
3	8 weeks	4.58	1.42	4.42	4.74	<0.0001
4	12 weeks	3.19	1.22	3.06	3.33	<0.0001
5	16 weeks	2.16	1.23	2.02	2.30	<0.0001
6	20 weeks	1.13	1.14	1.00	1.26	<0.0001

Table 2: Pain VAS in the study population (n=300)

S No	Pain VAS	Mean	SD	95% CI		P - value
				Lower bound (α=2.5%)	Upper bound (α=97.5%)	
1	Before treatment	7.37	1.14	7.08	7.65	
2	4 weeks	5.65	1.49	5.28	6.02	<0.0001
3	8 weeks	4.65	1.54	4.27	5.03	<0.0001
4	12 weeks	2.98	1.11	2.71	3.26	<0.0001
5	16 weeks	2.00	1.15	1.72	2.28	<0.0001
6	20 weeks	1.00	1.11	0.73	1.27	<0.0001

Table 3: Pain VAS in the osteoarthritis knee patients (n=108)

S No	Pain VAS	Mean	SD	95% CI		P - value
				Lower bound (α=2.5%)	Upper bound (α=97.5%)	
1	Before treatment	70.00	6.22	68.46	71.54	
2	4 weeks	77.57	5.17	76.30	78.85	<0.0001
3	8 weeks	83.70	3.64	82.80	84.60	<0.0001
4	12 weeks	86.71	3.08	85.95	87.48	<0.0001
5	16 weeks	89.40	2.51	88.78	90.02	<0.0001
6	20 weeks	91.98	2.76	91.30	92.67	<0.0001

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Figure 1: Blood is centrifuged at a speed of 3000rpm/min, for 3 minutes

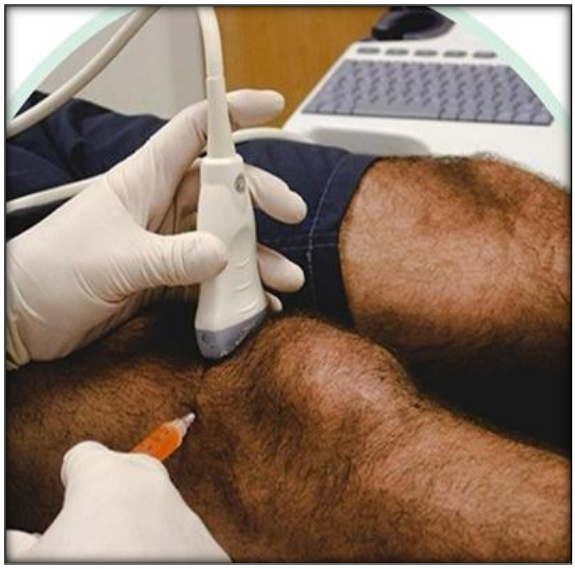

Figure 2: USG guided infiltration with Platelet Rich Plasma using C-Arm guidance

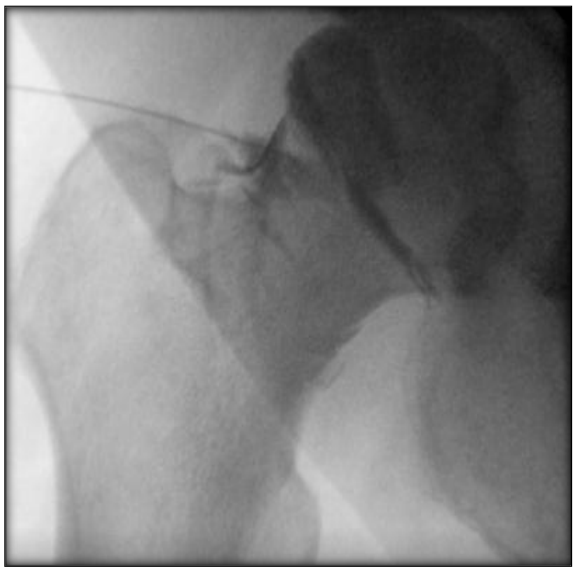

Figure 3: Platelet Rich Plasma infiltration

DISCUSSION

Platelet-rich plasma (PRP) has been suggested, as a potentially effective biologic intervention, with diverse uses within the field of sports medicine.[21] The type of injury is important, since it has been demonstrated to be beneficial in treating Enthesopathies and osteoarthritis (OA), yet not as effective in Achilles tendinopathy as well as hamstring injuries.[22] The existing body of clinical research on platelet-rich plasma (PRP) as a therapeutic intervention indicates promising potential in alleviating pain and enhancing functionality in cases of articular injuries affecting the ankle, knee, and hip.[23] The variable and ambiguous nature of the data base supporting the use of platelet-rich plasma (PRP) in various injury types has been a subject of criticism.[24] Grassi et al. conducted a meta-analysis and recommended PRP therapy as a safe minimally interventionist therapy with negligible negative effects.[25] They also highlighted its accessibility and low risk of hypersensitivity compared to other external substances, thanks to the autologous character of PRP injections.[26]

Furthermore, OA has traditionally been regarded as a chronic painful condition with no known absolute cure.[27] PRP injections in knee osteoarthritis (OA) are intended to promote cartilage regeneration and alleviate the painful restrictive symptoms of osteoarthritis, potentially postponing the necessity for a major joint replacement surgery.[28] PRP injections have demonstrated a significant impact on the whole joint environment, resulting in a clinical enhancement.[28] PRP injections are regarded as a secure interventionalistic therapy, with more advantageous results compared to other therapies[28]. Platelet-Rich Plasma (PRP) is a simple to use since it can be easily prepared quickly and administered with minimal invasiveness through a simplistic intra-articular injection.[29] The utilization of the patient's own protein is expected to mitigate the adverse side effects, while the concentration of bioactive molecules can be optimized to attain the intended dosage, hence mitigating the risk of potential reactions.[29] In the absence of a synthetic component, Platelet-Rich Plasma (PRP) is generally not classified as a pharmaco-therapeutic agent, hence obviating the necessity to adhere to the regulatory prerequisites associated with other biologic treatments.[29]

In our study, we found significant improvement in Enthesopathies, and improved the clinical and functional outcomes in osteoarthritis of weight bearing and non-weight bearing joints. The effects are long lasting and USG guided infiltration helps in targeting the damaged tissue yielding better outcomes. The quality of life and activities of daily living improved significantly following PRP injection.

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This regenerative and reparative ability of PRP is attributed to many a growth factors and potential proteins. The following seem to be the contributing factors. A. PGDF, VEGF and β – TGF which are responsible for neo – angiogenesis, synthesis of collagen resulting in tissue reparative processes. B. It has a pain modulatory effect. C. Cartilaginous degenerative repair and partial regeneration.[30]

Rare complications however are chance of infections, local discomfort or pain at infiltration site, neurovascular inadvertent injuries, allergogenic reactions, symptom accelerated progression, haematological interference in the coagulation cascade and immunogenic reactions. Strict compliance to aseptic precautions, adherence to post injection care, rehabilitation and follow-up appointments, can almost nullify the complications and yield, excellent to good, clinico-functional outcomes in many a orthopaedic maladies.[30]

The main limitation of our study is that it is an interventional study and not a comparative study. Additional large randomized controlled trials (RCTs) are required to further evaluate the effectiveness and duration of benefit of platelet-rich plasma (PRP) therapy.

CONCLUSION

Based on scientific research and clinical trials, it can be concluded that the use of platelet rich plasma, is both safe and effective in advancing healing of tissues and delivering relief from pain. The Hallmark of PRP interventions are that that they are safe, autologous, affordable, invasive very minimally and can be executed as a Day-Care Procedure.

Conflict of Interest: The authors declare that there has been No Conflict of Interest and have received no funding for the study conducted.

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