Section: Orthopaedics

Original Research Article

OUTCOME OF PATIENTS WITH OSTEOARTHRITIS OF THE KNEE JOINT TREATED BY AUTOLOGOUS INJECTION OF PLATELET-RICH PLASMA

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ABSTRACT

Background: Degenerative osteoarthritis (OA) of the knee is a common condition affecting the elderly, with a prevalence of 28.7% in India. Factors like aging, obesity, and lack of education are primary contributors to the condition. OA results in the progressive degeneration of articular cartilage, causing significant limitations in daily activities such as walking, climbing stairs, and squatting. Although various treatment options exist, there is no clear consensus on the management of different stages of OA. Platelet-rich plasma (PRP) injections have emerged as a promising treatment due to their potential to repair cartilage, reduce pain, and improve joint function.

Materials and Methods: This prospective study involved 70 patients with primary knee OA selected randomly from outpatient clinics. Radiographic evaluation confirmed the stage of arthritis. PRP was prepared by collecting 10-20 ml of the patient's blood, which was centrifuged to separate the plasma. The PRP was injected intra-articularly under aseptic conditions. Pain and functional status were evaluated using the Visual Analog Scale (VAS) and Oxford Knee Score questionnaires before and six months after the procedure.

Results: There were 40 (36.67%) females and 30 (63.33%) males with a M:F ratio of 0.75:1. The most common affected age group was 51–60 age group (40.0%). After a single dose of PRP injection in 70 OA knee patients, 84% showed excellent/good pain relief, 12.8% satisfactory and 2.8% poor results at 6 months. Oxford Knee Scores revealed excellent outcomes in 60%, good in 24.28%, satisfactory in 12.85%, and poor in 2.86%. Improvements were statistically significant, with no complications or adverse reactions observed.

Conclusion: PRP injections are a safe, simple, and cost-effective outpatient treatment for knee OA. It alleviates pain, improve range of motion and promote cartilage repair by reducing inflammation and enhancing local angiogenesis. While slower acting than steroids PRP is free of harmful local or systemic side effects making it an ideal option for managing knee arthritis at various stages.

Keywords: Osteoarthritis, Knee, Platelet-Rich Plasma, Intra-Articular Injections, Functional Outcome.

INTRODUCTION

Degenerative Osteoarthritis of knee joint is one of the commonest conditions affecting elderly person. The overall prevalence of OA knee joint in India is 28.7%. 13% of female and 10% of male above 60 years or older have symptomatic Osteoarthritis (OA).[1] Aging, Obesity, lack of education are the main factors that causes arthritis of knee joint in elderly population. Female having more incidence of OA knee compared to male documented in meta-analysis. This is due to hormonal issue affecting females after

menopause. Logistic regression analysis shown a significant association of female sex and age >50 years with all sites of OA. African and Americans have slightly higher prevalence of knee symptoms compare to Caucasians.[2]

The basic pathology of primary degeneration of articular cartilage is the eburnation of articular cartilage with age, exposing the underline subchondral bone of medial compartment of knee joint to mechanical pressure. This causes inflammatory reaction, effusion and synovitis leading to arthritis, ligament laxity and deformities.[3] The pain in knee joint due to arthritis significantly affect the range of movement, functional status and causes deformity and at the end instability due to bone loss and ligament laxity Activity of daily living like walking, sitting cross leg, squatting, climbing and getting down of staircase get significantly affected as the disease progressed to higher stages of arthritis.[4]

There are no clear guidelines for managing OA knee joint. Many noninvasive and invasive procedures are available in medical practice. Intra articular injection of Platelet rich plasma (PRP) is one of them. The treatment of cartilage regeneration or repair is still unclear. To restore cartilage defects and restoration of hyaline cartilage procedures like microfracture, osteochondral auto graft, allograft or autologous chondrocytes implantation or mesenchymal stem cells have been tried but there is no evidence of formation of near natural hyaline cartilage. Hence newer, novel safe and cost-effective technique of injecting PRP in the joint to repair cartilage by presenting chondroprotective, regenerative, reparative anti-inflammatory effect on chondrocytes and reducing the pain and improving the overall function of knee is hypothesized in literature.[5]

We conducted this study to analyze the efficacy of PRP injection in a general population, affected with different stages of knee arthritis before it gets completely damaged in controlling pain, inflammation and hence improving function and the quality of life. In this study 70 patients selected randomly were treated intra articular injection of PRP on OPD basis with all aseptic precautions. Improvement in range of movement and functional recovery was interpreted by using Oxford Knee Score questionaries and assessment of knee pain by Visual Analogue Score pre and post intra articular PRP injection in affected knee joint.

MATERIALS AND METHODS

This was a hospital-based study prospective study carried out at Orthopedic OPD at KIMS General Hospital, Amalapurum, Andhra Pradesh and study population. 70 Adult patients having degenerative arthritis of knee joint between age group of 35 and 85 years were included in this study on the basis of a predefined inclusion and exclusion criteria. The study was carried out between February 2022 to May 2024.Institutional Ethics committee approved the study and informed and written Consent was obtained for the procedure as well for being part of study.

On arrival demographic data was taken in the form of age, gender, address, occupation. Interpretation of right knee pain, left knee pain or bilateral knee pain, difficulty in walking, difficulty in carrying out activity of daily living by asking 12 questionnaires of Oxford Knee Scores.6 Oxford knee score consists of score 0,1,2,3,4 where 0 is worst and 4 is excellent or normal. So, the maximum score 48 is normal / excellent and 0 is worst/ poor in outcome. [Table 1]

On examination presence of joint line tenderness, joint effusion, range of movement, valgus, varus and flexion deformity and ligament laxity noted. Patients were then evaluated radiologically, with both knee AP standing and graded for knee arthritis according to Kellgren-Lawrence (KL),[7] scoring system (stage 0,1,2,3). Pain threshold was evaluated with Visual Analogue Scale (VAS),[8] on arrival and status of knee pain was also evaluated once again with Oxford knee score and VAS after 6 months of PRP injection. Total injection PRP were given =133 in which both knees were 126, only right knee medial compartment =5 and only left knee medial compartment were 2. Patients were evaluated on arrival and at the end of 6-month after intra-articular injection. Each patient was given 1:1 physiotherapy in the form of exercises, ultrasonics and IFT treatment whenever required. NSAID were stopped 7 days before injection and continued after 1 month of PRP injection as and when required for pain control. The difference in Oxford knee score and VAS score between arrival and at the end of six months was noted. Depending upon the final VAS and Oxford knee score for INJ PRP in osteoarthritis of knee joint result was graded at the end of six month as Excellent (48-40), Good (39-30), Satisfactory (29- 20) and Poor (19-0) and total percentage was calculated and compared with other studies published earlier.

All patients were thoroughly informed about the procedure. Based on the knee involvement and compartment affected, the procedure was performed under strict aseptic precautions. For one knee, 10 ml of blood was withdrawn, and for both knees, 20 ml was collected from the forearm vein into a citrate bulb. The blood was centrifuged using a 4-chambered centrifuge machine from Reno company, maintained in the OPD. The first centrifugation was performed at 1500 RPM for 10 minutes, followed by a second centrifugation at 2000 RPM for another 10 minutes. After centrifugation, the superficial layer of platelet-poor plasma was discarded and the platelet-rich plasma above the clot was collected for intra-articular injection.

The knee joint was scrubbed with 7% beta scrub, cleaned with spirit, and painted with 10% betadine solution. The site was draped with a plastic sheet. A 2% lignocaine injection was administered at the injection site before injecting the platelet-rich plasma. Passive range of motion of the knee joint was performed several times after the injection. A sterile gauze piece was placed at the injection site, secured

with paper tape, and the patient was observed for 30 minutes in the OPD. Once comfortable, the patient was allowed to go home.

NSAID medications were stopped for one month since aspirin and other NSAIDs lower platelet levels, potentially reducing PRP efficacy. Patients were encouraged to perform daily physiotherapy, including quadriceps and hamstring strengthening exercises. No other intra-articular injections, such as hyaluronic acid or steroids, were permitted. Local therapies like ultrasonics, interferon therapy, and ice packs were allowed. Patients were regularly followed up, and final assessments were conducted six months post-procedure using VAS and Oxford Knee Score. Side effects and complications were documented throughout the six-month period.

The data was collected and analyzed using SPSS software 23.0. Descriptive statistics were calculated for the overall sample and for follow up and for pathology. Categorical variables were presented as numbers or percentage. Continuous variables not normally distributed were presented as median and range whereas normally distributed variables were presented as mean and standard deviation. The Shapiro-Wilk test was used to test for normality of the data Mann-Whitney U tests or Kruskal-Wallis tests for group comparisons were conducted for follow ups.

Inclusion Criteria:

- Patients aged 35 to 85 years.
- Willing to give informed and written consent to be part of study.
- Primary osteoarthritis of the knee joint with X-ray showing Kellgren-Lawrence (K-L) grade 1 to 3 degenerative changes.
- Patients experiencing significant knee pain not relieved with analgesics or other local noninvasive therapies over a longer duration.

Exclusion Criteria

- Age less than 35 years or above 85 years.
- Refusal to give written consent to be part of study.
- Patients with severe arthritis classified as K-L stage 4 with subluxation.
- Severe varus, valgus, or flexion deformities or Grade III ligamentous laxity.
- Traumatic or inflammatory arthritis.
- Severe acute knee effusion or infective arthritis

Table 1: Components of Oxford knee score

Question	During the past 4 weeks	Options (0 = Worst, 4 = Excellent)
1.	How would you describe the pain in your knee?	4. None 3. Very Mild 2. Mild 1. Moderate 0. Severe
2.	How long can you walk (with or without stick) before the pain in your knee becomes severe?	4. No pain/more than 30 mins 3. 16-30 mins 2. 5-15 mins 1. Around the house only 0. Not at all/pain severe
3.	After a meal (sat at a table), how painful is the knee to stand up?	4. Not at all painful 3. Slightly painful 2. Moderately painful 1. Very painful 0. Unbearable
4.	Have you been troubled by pain from your knee in bed at night?	4. No nights 3. Only 1 or 2 nights 2. Some nights 1. Most nights 0. Every night
5.	How much has pain from your knee interfered with your usual work (including housework)?	4. Not at all 3. A little bit 2. Moderately 1. Greatly 0. Totally
6.	Could you walk down one flight of stairs?	4. Yes, easily 3. With little difficulty 2. With moderate difficulty 1. With extreme difficulty 0. No, impossible
7.	Have you been limping when walking because of your knee?	4. Rarely/never 3. Sometimes, or just at first 2. Often, not just at first 1. Most of the time 0. All of the time
8.	Have you felt that your knee might suddenly “give way” or let you down?	4. Rarely/never 3. Sometimes, or just at first 2. Often, not just at first 1. Most of the time 0. All of the time
9.	Could you kneel down and get up again afterwards?	4. Yes, easily 3. With little difficulty

		2. With moderate difficulty 1. With extreme difficulty 0. No, impossible
10.	Have you had any trouble with washing and drying yourself (all over) because of your knee?	4. No trouble at all 3. Very little trouble 2. Moderate trouble 1. Extreme trouble 0. Impossible to do
11.	Have you had any trouble getting in and out of a car or using public transport because of your knee?	4. No trouble at all 3. Very little trouble 2. Moderate trouble 1. Extreme trouble 0. Impossible to do
12.	Could you do the household shopping on your own?	4. Yes, easily 3. With little difficulty 2. With moderate difficulty 1. With extreme difficulty 0. No, impossible

RESULTS

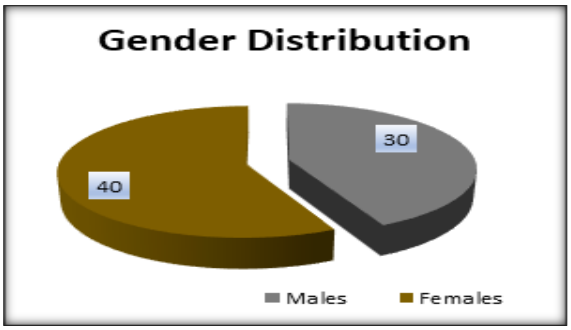

Figure 1: Gender Distribution of the Studied Cases.

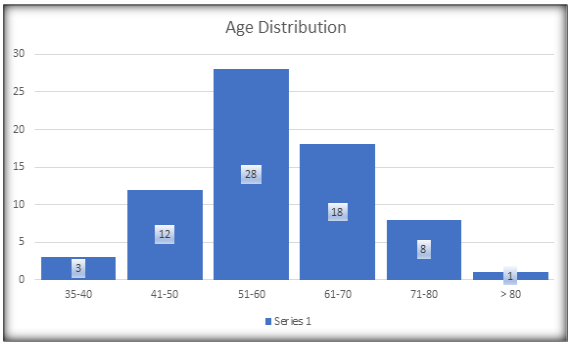

Figure 2: Age Distribution of studied cases.

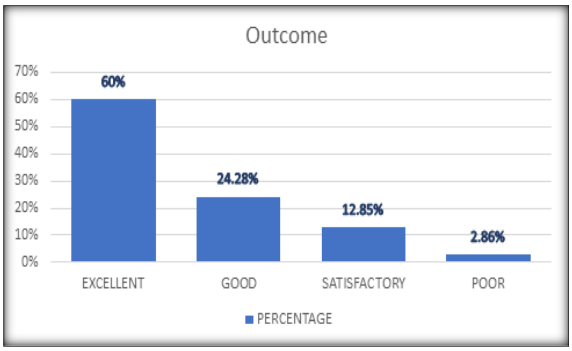

Figure 3: Outcome of cases of osteoarthritis knee treated by platelet rich plasma injection.

A total of 70 patients were included in this study out of which there were 40 (36.67%) females and 30 (63.33%) males with a M:F ratio of 0.75:1. [Figure 1]

The analysis of the age distribution of the studied cases showed that the majority of individuals were in the 51–60 age group (40.0%). This was followed by the 61–70 age group (25.7%) and the 41–50 age group (17.1%). The 71–80 age group had 8 participants (11.4%), while the 35–40 and >80 age groups had 3 (4.3%) and 1 (1.4%) individual respectively. [Figure 2]

The analysis of the outcomes of osteoarthritis knee cases treated with platelet-rich plasma injection revealed that the majority of patients experienced excellent results, accounting for 60% of the cases. This was followed by good outcomes observed in 24.28% of cases, while satisfactory outcomes were reported in 12.85%. A small proportion of patients, 2.86%, had poor outcomes. [Figure 3]

Majority of participants had involvement in both knees, with 63 cases (90.00%), followed by right knee involvement in 5 cases (7.14%) and left knee involvement in only 2 cases (2.86%). Regarding the Kellgren-Lawrence scale, the most common grade was grade 2, observed in 42 cases (60.00%), followed by grade 3, which was present in 26 cases (37.14%). Grade 1 involvement was noted in only 2 cases (2.86%), while no cases were classified as grade 0 (0.00%). Bilateral knee involvement was predominant, and most cases fell within moderate (grade 2) and severe (grade 3) levels on the Kellgren-Lawrence scale. [Table 2]

The analysis of the severity of pain, as assessed by the Visual Analog Scale (VAS), revealed significant changes before and six months after PRP injection. At presentation, the majority of cases (60%) experienced severe pain (7-9), followed by moderate pain (4-6) in 28 cases (40%). None of the cases reported no/mild pain (0-3) or worst pain (10). However, six months after PRP injection, a remarkable improvement was observed, with the majority of cases reporting no/mild pain (0-3) in 59 cases (84.29%). Moderate pain (4-6) was seen in 9 cases (12.86%), while severe pain (7-9) was seen in only 2 cases (2.86%). No cases reported worst pain (10) during this period. [Table 3]

The analysis of the mean VAS scores before and after PRP injection indicates a substantial reduction in pain levels. There was a marked reduction in severity of

pain in almost all cases and the difference was statistically highly significant (P<0.0001). [Table 4]

Table 2: Knee involvement and Kellgren-Lawrence scale

		No Of cases	Percentage
Knee Involvement	Both Knee	63	90.00%
	Right Knee	5	7.14%
	Left Knee	2	2.86%
Kellgren-Lawrence scale	0	0	0.00%
	1	2	2.86%
	2	42	60.00%
	3	26	37.14%

Table 3: Comparison of VAS score at the time of presentation and 6 months after PRP injection

Severity of pain (VAS Score)	No Of cases	Percentage
At Presentation		
No/Mild Pain (0-3)	0	0
Moderate Pain (4-6)	28	40 %
Severe Pain (7-9)	42	60 %
Worst Pain (10)	0	0
6 Months After PRP Injection		
No/mild Pain (0-3)	59	84.29%
Moderate Pain (4-6)	9	12.86%
Severe Pain (7-9)	2	2.86%
Worst Pain (10)	0	0.00%

Table 4: Mean VAS scores at presentation Vs at 6 months follow up and test of significance

Time point	Mean VAS Score	Standard Deviation
Before PRP Injection	6.8	1.47
After PRP Injection	1.88	1.16
P < 0.0001* (Highly Significant)		

DISCUSSION

Primary degenerative osteoarthritis (OA) of the knee is common sequelae of diseases affecting approximately 250 million people worldwide and 4% of the global population.[9] The prevalence of primary degenerative knee arthritis in India is approximately 25%. The pathology of osteoarthritis involves the eburnation of articular cartilage primarily due to aging. This eburnation is particularly common in the medial compartment of the knee joint which bears more load due to its alignment. postmenopausal women are particularly vulnerable due to hormonal changes and osteoporosis. While degenerative arthritis typically affects both knees, one may be more symptomatic than the other. Advancing age and osteoporosis exacerbate arthritis progression.[10]

The pathophysiology of OA includes cartilage erosion, subchondral bone rubbing, inflammation, synovial thickening and joint instability. Early signs of arthritis include osteophytes at the articular margin with varying sizes depending on the disease stage. Symptoms of osteoarthritis include medial joint line tenderness, restricted range of motion and difficulty with activities like climbing stairs or squatting. Common imaging features include joint space narrowing, osteophyte formation, subchondral sclerosis and tibial subluxation. The Kellgren-Lawrence classification grades OA from 0 to 4 based on these findings.[11]

Treatment for OA lacks specific guidelines. Non-invasive options include NSAIDs, and physiotherapy. Other management options include modalities like ultrasound, diathermy and wax baths. Intra-articular steroids provide temporary relief but have side effects with repeated use. Hyaluronic acid injections are costly and yield inconsistent results. platelet-rich plasma (PRP) therapy is a novel, non-invasive treatment with promising results in reducing pain and inflammation as is also have cartilage regeneration properties.[12]

PRP consists of autologous blood-derived components that includes platelet-derived growth factors (PDGF), fibroblast growth factors, vascular endothelial growth factors and cytokines. These factors help in reducing inflammation and cause enhanced angiogenesis thereby promoting tissue repair.[13] Platelets contain bioactive granules that stimulate mesenchymal cells, fibroblasts, and osteoblasts which are responsible for facilitating tissue repair and regeneration. PRP improves synovial fluid homeostasis, promotes hyaluronic acid production and reduces inflammatory cytokines. All these changes result in pain reduction, improved joint function, and delayed need for surgical interventions.[14]

In this study Oxford Knee Scoring System was used to evaluate outcomes. Excellent results were observed in 60% of patients, good results in 24.28%, satisfactory results in 12.85%, and poor results in 2.22%. Poor outcomes were associated with advanced age, poor bone quality, and lack of physiotherapy. Early-stage OA patients aged 37–70 showed excellent to good outcomes, while moderate arthritis patients aged 70–79 had satisfactory results.

Giuseppe Filardo et al conducted a meta-analysis of randomized controlled trials to evaluate the effectiveness of platelet-rich plasma (PRP) injections in improving patient-reported outcomes for knee osteoarthritis compared to placebo and other intra-articular treatments.[15] For this purpose, the authors analyzed data from 34 randomized controlled trials that included 1403 knees treated with PRP and 1426 knees in control groups. The studies were identified through comprehensive searches of PubMed, Cochrane Library, Scopus, Embase and Web of Science. The risk of bias was assessed using Cochrane guidelines, and evidence quality was graded with the GRADE system. The study found that PRP injections significantly improved outcomes compared to placebo and other treatments. Specifically, PRP showed a statistically and clinically significant improvement in the WOMAC score versus placebo at the 12-month follow-up ($P = 0.02$) and versus hyaluronic acid at both 6 months ($P < 0.001$) and 12 months ($P < 0.001$). PRP also showed significant benefits over steroids for VAS pain ($P < 0.001$), KOOS pain ($P < 0.001$), daily activity function ($P = 0.001$), and quality of life ($P < 0.001$) at 6 months. On the basis of these findings, the authors concluded that PRP injections are more effective than other injectable options for knee osteoarthritis. Similar Beneficial effects of PRP injection in cases of knee osteoarthritis have also been reported by the authors such as Kim JH et al,[16] and Wang R et al.[17]

Compared to intra-articular steroids PRP offers long-term benefits with fewer side effects. Hyaluronic acid injections are costly and not recommended as first-line treatment.[18] Mesenchymal stem cell injections for OA show limited and controversial results. Surgical interventions like high tibial osteotomy and total knee replacement are effective but invasive, and are associated with complications of surgeries such as risk of infection, anesthesia complications and implant failure.[19] Revision surgeries, often required after 10–15 years pose additional challenges.[20] Therefore, in severe osteoarthritis knee cases PRP injection can be an effective as well as safe alternative to invasive surgical interventions. In this study, PRP injections resulted in significant pain relief without significant complications.

CONCLUSION

PRP injection is a novel, safe, cost-effective procedure performed on an outpatient basis to manage knee OA pain. PRP shows excellent results in early and mild cases and good to satisfactory results in moderate OA. It offers a slow-acting but long-term alternative to steroids and other treatments. However, further studies are needed to optimize PRP dosage, injection frequency, and additional therapies to enhance outcomes, delay surgical interventions, and improve cost-effectiveness.

Conflict of Interest: None.

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