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A prospective comparative study of functional outcome following platelet-rich plasma versus Triamcinolone injection for treatment of early primary osteoarthritis knee

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ABSTRACT

Background: Osteoarthritis in knee joints is very common in developing countries in middle aged and elderly populations. Triamcinolone and platelet rich plasma (PRP) injections can increase the functional outcome and delayed need for surgical intervention in early primary osteoarthritis. This study is aimed to evaluate the functional outcome and the total time effect of the injection in the patients.
Methods: This is a prospective comparative study which included 100 patients out of which 50 were given triamcinolone injection and 50 were given PRP injection. Patients were selected as per grade 1 and grade 2 according to Kellgren Lawrence grade.
Results: Among 100 patients 71 were male and 29 were female with most common age group being 51 to 60 years followed by 41 to 50 years. Out of 100 patients grade 1 consisted of 69 patients and grade 2 consisted of 31 patients. The triamcinolone group had immediate better functional outcome for an average of 3-6 months whereas PRP injections had better outcome for an average of 6-12 months.
Conclusions: Patients injected with triamcinolone had an immediate better functional outcome for an average of 3-6 months whereas PRP injections had a delayed betterment of functional outcome which lasted for an average of 6-12 months.

Keywords: Knee osteoarthritis, Triamcinolone, Platelet rich plasma

INTRODUCTION

Osteoarthritis (OA) is a progressive, polygenic disease influenced by factors such as age, female gender, obesity, prior injuries, and joint laxity. Knee OA is the most common form in the lower limbs, affecting about 23% of arthritis cases and up to 13% of women and 10% of men over 60.[1] Its prevalence is higher in rural India. OA leads to pain, reduced mobility, and increased cardiovascular risks due to inactivity.[2]

The primary goals of treatment are pain relief, functional preservation, and slowing disease progression. Initial management involves non-pharmacological measures (education, weight control, and exercise) and oral non-opioid analgesics. When oral therapies fail, intra-articular injections—mainly corticosteroids or newer options like platelet-rich plasma (PRP)—are used.[3] Corticosteroids provide anti-inflammatory effects but their optimal type and dose remain debated. PRP, derived from autologous blood and rich in platelets, WBCs, cytokines, and growth factors, enhances tissue repair and regeneration.[4]

Although both corticosteroids and PRP have shown efficacy in knee OA, evidence remains limited and sometimes conflicting. Few studies have directly compared the two, especially with repeated dosing. The present study intends to compare PRP versus corticosteroid injections in knee OA at three follow-ups, using the visual analogue scale (VAS) and knee society

score (KSS) to evaluate outcomes, patient compliance, and adverse events.

METHODS

Study design and setting

This prospective comparative study was conducted at Dr. M. K. Shah Medical College and Research Center and SMS Multi-speciality Hospital, Ahmedabad, Gujarat, India from April 2023 to June 2024 which included 100 patients with knee pain and diagnosed with early primary osteoarthritis by X-rays.

The knee society score and visual analogue score of each patient was recorded.

Method of giving injection

Group PRP

The standard radiographic evaluation included standing AP and Lateral 30-degree flexion view. The patients were classified according to the Kellgren-Lawrence classification. 50 patients who belong between the grade 1 and 2 of above classification were included in this study. Following this complete CBC study of the patients was done. All the 50 patients were subjected to visual analogue score and knee severity score. These scores were collected prior to treatment as well as subsequently at 1-, 3-, 6-, and 12-months follow-up. Procedure and preparation of pure platelet-rich plasma was done using the double-spin method as follows. 20 ml of venous autologous whole blood was collected via blood draw, maintaining all aseptic precautions, into tubes containing tri-sodium citrate as anticoagulant. The collected blood was then spun down using autologous platelet separator system at 1000 rpm (soft spin) for a duration of 10 minutes. This first spin yielded three layers to separate red blood cells at the bottom of the tube, buffy coat containing white blood cells in the middle and plasma layer above. Then, the portion of plasma was transferred into another plain tube, not containing anticoagulant, and centrifuged a second time at 2000 rpm (hard spin) for 10 minutes. This yielded a PRP layer at the bottom of the tube and a platelet-poor plasma layer (PPP) in the upper part of the tube. This PPP layer was removed and calcium gluconate was added to act as an activator of PRP. Under aseptic conditions, the injection procedure was carried out in the operation theatre. The patient was placed in sitting position on the operation table with the knee flexed to 90 degrees. The procedure site was painted and draped with povidone-iodine solution. A 26-gauge needle was attached to a 5 ml syringe filled with the PRP preparation composed of 3 ml of PRP. Injection was given in the affected knee from either anterolateral or medial route. The skin was cleaned and a sterile bandage was applied over the needle puncture site. The patient was further monitored for 10 minutes in order to watch for any adverse reactions. The patient was then advised to avoid strenuous work, squatting or sitting crossed legged and to do ice fomentation.

Group triamcinolone

The standard radiographic evaluation included standing AP and lateral 30-degree flexion view. The patients were classified according to the Kellgren-Lawrence classification. 50 patients who belong between the grade 1 and 2 of above classification were included in this study. Following this RBS study of the patient was done. All the 50 patients were subjected to visual analogue score and knee severity score. These scores were collected prior to treatment as well as subsequently at 1, 3, 6, and 12 months follow-up.

Under aseptic conditions, the injection procedure was carried out in the operation theatre. The patient was placed in sitting position on the operation table with the knee flexed to 90 degrees. The procedure site was painted and draped with povidone-iodine solution. A 26-gauge needle was attached to a 5 ml syringe filled with the triamcinolone 40 mg (1 ml) and 1 ml plain lignocaine preparation. Injection was given in the affected knee from either anterolateral or medial route. The skin was cleaned and a sterile bandage was applied over the needle puncture site. The patient was further monitored for 10 minutes in order to watch for any adverse reactions. The patient was then advised to avoid strenuous work, squatting or sitting crossed legged and to do ice fomentation.

Investigations

Complete haemogram, random blood sugar and X-ray (right/left/bilateral knee AP (standing), lateral) were done.

Inclusion criteria

Male and female patients age more than 40 years, grade 1 and 2 OA knee as per Kellgren Lawrence grade, patients who gave consent and normal RBS and platelet count more than 2.5 lakhs were included.

Exclusion criteria

Patients less than 40 years, grade 3 and 4 OA knee as per Kellgren Lawrence grade, increased RBS and platelet count less than 2.5 lakh, patients with no consent, with rheumatoid arthritis, history of trauma, operative history of knee, and patients with any history of any knee related infections were excluded.

Statistical analysis

The data was entered and cleaned using Microsoft Excel and analyzed statistically using statistical package for the social sciences (SPSS) 25. Quantitative variables were expressed as mean value ± standard deviation or median ± interquartile range. Qualitative data was expressed as percentages (%) and proportion. Appropriate statistical

test was used to infer association between 2 variables and a $p<0.05$ was considered statistically significant.

RESULTS

Baseline characteristics, including gender distribution, age, KL grading, laterality of osteoarthritis, and duration of symptoms, were comparable between the triamcinolone and PRP groups, with no statistically significant differences ($p>0.05$). At 1- and 3-month follow-up, patients receiving triamcinolone showed slightly better improvement in KSS pain scores compared to PRP, though this difference was not statistically significant. In contrast, at 6 and 12 months, patients in the PRP group demonstrated superior pain and functional outcomes, with a statistically significant difference observed at 12 months ($p=0.04$). Functional assessment revealed consistently higher mean KSS functional scores in the PRP group at 3, 6, and 12 months, with statistically significant differences ($p=0.04$, 0.04, 0.001, respectively).

VAS scores at baseline were similar between the two groups (6.12 versus 6.08). At 1 month, PRP patients showed significantly lower VAS scores compared to triamcinolone ($p=0.04$). This trend persisted at 6 and 12 months, with PRP demonstrating significantly greater pain reduction ($p=0.005$, 0.003). Adverse events were minimal in both groups, with one case each of hypopigmentation and synovitis in the triamcinolone group, and one case each of local redness and injection-site pain in the PRP group. While triamcinolone provided short-term symptom relief, PRP demonstrated superior and sustained improvement in both pain and function over long-term follow-up, with minimal adverse effects. PRP may therefore represent a more effective therapeutic option than corticosteroids for the management of knee osteoarthritis.

Table 1: Distribution of patients according to duration of symptoms.

Duration of symptoms (months)	Groups		χ^2, P value
	Triamcinolone N (%)	PRP N (%)	
<6	14 (28)	12 (24)	0.39, 0.82
6 to 12	21 (42)	24 (48)	
>12	15 (30)	14 (28)	
Total	50 (100)	50 (100)	

Table 2: Comparison of mean KSS (pain) scores between two groups.

KSS pain	Groups		T-statistics, P value
	Triamcinolone (mean±SD)	PRP (mean±SD)	
Before injection	62.82±5.02	62.56±4.60	0.27, 0.79
At 1 month	67.24±3.65	67.06±3.38	0.25, 0.80
At 3 months	69.28±3.09	69.06±3.46	0.33, 0.74
At 6 months	72.92±4.05	74.02±3.23	-1.49, 0.14
At 12 months	75.64±3.29	76.86±3.03	-1.93, 0.04

Table 3: Comparison of mean KSS (function) scores between two groups.

KSS function	Groups		T-statistics, P value
	Triamcinolone (mean±SD)	PRP (mean±SD)	
Before injection	83.00±4.63	83.90±3.81	- 1.06, 0.29
At 1 month	83.30±4.47	84.40±3.73	- 1.33, 0.18
At 3 months	83.80±3.98	85.30±3.83	- 1.92, 0.04
At 6 months	84.80±3.77	86.60±4.89	- 2.06, 0.04
At 12 months	87.40±4.43	91.10±5.82	- 3.57, 0.001

Table 4: Comparison of mean VAS scores between two groups.

VAS score	Groups		T-statistics, P value
	Triamcinolone (mean±SD)	PRP (mean±SD)	
Before injection	6.12±0.98	6.08±0.94	0.21, 0.83
At 1 month	5.80±0.88	5.46±0.73	2.09, 0.04
At 3 months	5.12±0.87	4.84±0.65	1.82, 0.07
At 6 months	4.04±0.78	3.60±0.75	2.86, 0.005
At 12 months	2.56±0.73	2.10±0.79	3.02, 0.003

Table 5: Distribution of adverse effects between two groups.

Adverse effects	Groups	
	Triamcinolone, N (%)	PRP, N (%)
Hypopigmentation	01 (02)	00 (00)
Synovitis	01 (02)	00 (00)
Local redness	00 (00)	01 (02)
Pain at injection site	00 (00)	01 (02)

DISCUSSION

This study compared intra-articular triamcinolone and PRP injections in early primary knee osteoarthritis.[5] Triamcinolone, a corticosteroid, provides rapid anti-inflammatory pain relief but with short-term effects and risks when used repeatedly.[5,6] In contrast, PRP is a regenerative therapy delivering autologous platelets and growth factors to promote tissue repair and potentially modify disease progression, though its effects vary due to differences in preparation methods and patient selection.[7]

In the present study, baseline socio-demographic factors (age and sex), KL grading, laterality of OA, and symptom duration were comparable between groups, with no statistically significant differences. At 1–3 months, triamcinolone showed better short-term pain relief (KSS pain score), while PRP demonstrated significantly greater improvements in both KSS functional scores and VAS pain scores at 6 and 12 months ($p<0.05$). These findings align with other studies reporting early benefits from corticosteroids but superior mid- to long-term outcomes with PRP. Adverse effects were minimal and comparable: triamcinolone was associated with isolated cases of hypopigmentation and synovitis, while PRP caused transient local redness or pain. Similar studies also reported PRP to be safe, with only mild, self-limiting side effects.

Triamcinolone remains useful for short-term symptom relief, especially in acute flares, whereas PRP offers more sustained improvement in pain and function, making it a promising therapeutic option in early OA. Clinical decisions should consider patient characteristics, treatment goals, and long-term safety when choosing between the two modalities.

Limitations

Radiological outcome could have been assessed following intra-articular injections of triamcinolone and platelet rich plasma at follow-up periods. A larger sample size and inclusion of smaller age groups would have helped for better understanding of usage of these two injections in younger age group as well to reduce morbidity and improve quality of life among patients. Follow-up injections at regular intervals could have been given.

CONCLUSION

The comparison of intra-articular triamcinolone and PRP in early primary osteoarthritis highlights their distinct therapeutic roles. Triamcinolone provides rapid pain relief and functional improvement through strong anti-inflammatory effects, making it useful for acute symptom control, but its benefits are short-lived and repeated use carries risks. In contrast, PRP leverages autologous growth factors to promote tissue repair, reduce inflammation, and potentially modify disease progression, offering longer-term benefits though outcomes may vary due to preparation techniques. The findings emphasize the importance of personalized treatment planning based on patient characteristics, disease severity, and goals. Triamcinolone remains effective for short-term symptom relief, while PRP represents a promising, regenerative strategy for sustained improvement and possible disease modification. Future well-designed trials and long-term studies are needed to establish comparative effectiveness, optimize protocols, and guide evidence-based use of both therapies.

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