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Comparative outcome of platelet-rich plasma versus Corticosteroid injection in knee Osteoarthritis: Results of Randomized Control trial.

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Abstract

This randomized controlled trial aimed to compare the effectiveness of platelet-rich plasma (PRP) injections versus corticosteroid injections in managing knee osteoarthritis (OA). A total of 150 patients with mild to moderate knee OA, confirmed via X-ray, were randomized into two groups: 75 received PRP injections, while 75 received corticosteroid injections. Secondary outcomes included changes in pain levels using the Visual Analog Scale (VAS), improvements in the Knee Injury and Osteoarthritis Outcome Score (KOOS), and evaluation of adverse effects. Results demonstrated a significantly greater improvement in WOMAC scores for the PRP group (12.8 ± 3.1) compared to the corticosteroid group (6.2 ± 2.8, $p < 0.001$). Similarly, VAS pain reduction and KOOS functional scores were significantly better in the PRP group. No serious adverse effects were reported in either group. PRP's superior efficacy is likely due to its regenerative properties, which promote cartilage repair and reduce inflammation over the long term, whereas corticosteroids provide only short-term relief. The findings align with existing literature suggesting PRP's longer-lasting benefits in knee OA treatment. However, limitations include the relatively short follow-up period and variations in PRP preparation. Future research should focus on optimizing PRP protocols, assessing long-term effects, and exploring cost-effectiveness. These results support PRP as a more effective and safer alternative to corticosteroids for intra-articular therapy in knee OA.

Key words: Platelet-Rich Plasma, Knee Osteoarthritis, Corticosteroid Injections

Introduction

Osteoarthritis (OA) of the knee is a chronic condition marked by gradual deterioration of the cartilage, synovial membrane inflammation, and changes in the underlying bone[1]. OA is one of the pain's leading causes and disability around the globe and one of the diseases most affected by aging and increasing obesity rates. The prevalence of knee Osteoarthritis is increasing due to an aging population and rising levels of obesity. Traditional management strategies for knee OA involve the use of pharmacological methods such as NSAIDs and intra-articular steroid injections and non-pharmacological methods such as physiotherapy and control of body. These approaches don't seem to last long enough towards effective relief, so there is a need for other regenerative

techniques.[2]Platelet-rich plasma (PRP) has garnered tremendous interest as a biological treatment for knee osteoarthritis (OA), given its presumed abilities to modulate inflammation, enhance chondrocyte proliferation, and increase extracellular matrix synthesis.[3] Symptomatic relief and cartilage regeneration may be improved in PRP patients owing to the increased concentration of growth factors such as platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), and vascular endothelial growth factor (VEGF).[4] On the other hand, intra-articular corticosteroid injections are still heavily employed to treat knee OA because of their effective anti-inflammatory properties that result in significant pain relief through the suppression of pro-inflammatory cytokines such as interleukin-1 and tumor necrosis factor-alpha.[5] Nonetheless, worries regarding chondrotoxicity and low long-term treatment efficacy have stimulated research into other treatment approaches.[6] Several comparative studies of PRP and corticosteroids in knee OA have been done, but the findings are still contradictory because of differences in PRP preparation methods, patient demographics, and follow-up times.[7] Some studies claim that PRP allows patients to achieve a greater duration of pain relief and improved functionality compared to corticosteroids, while some other studies show the opposite with little to no benefits.[8]-[13] As a result of these differences, further higher-quality randomized controlled trials are required to produce clear answers about the effectiveness of both treatments.

The purpose of this study is to evaluate the clinical effectiveness of PRP and corticosteroid injections in patients with mild to moderate knee OA using objective measures such as the WOMAC score, VAS, and KOOS. This study hopes to assist knee OA patients by enabling clinicians to choose the correct intra-articular injection therapy for the management of knee OA.

Methodology: The trial was a multi-center, randomized, controlled, parallel study that took place in Department of Orthopedic Surgery Unit 2, Bolan Medical College and Bolan medical complex hospital Quetta from 2023-2024. Ethical approval was obtained from the institutional review board, and all participants gave informed consent before registering.

Participants

A total of 150 patients aged 40 to 75 years with x-ray-diagnosed Kellgren-Lawrence grade II to III longitudinal OA of the knee were thus recruited. Exclusion criteria includes history of intra-

articular injections 6 months prior, active infection, systemic inflammatory arthritis, undiagnosed diabetes, and Patients randomly assigned to either of two groups through a computer-generated allocation.

PRP Group (n=75): 3 intra-articular injections of leukocyte-poor PRP, thus given at two-weaks intervals

Corticosteroid Group (n=75): A single intra-articular injection of 40mg triamcinolone acetonide was administered.

Sample Size Calculation

The sample size was calculated using the Epi Info software based on the prior studies estimating the mean improvement in WOMAC scores in the PRP to be 10 +/- 5 and in the corticosteroid to be 6 +/- 5. The alpha was set at 5%, with the of the study being 80%. It was determined that each group would need at least 68 patients to begin with, being realistic about likely dropouts.

Outcome Measures

Primary Outcome: The primary outcome expected was the patient's total WOMAC score at six months was 0, and at follow-up of 6 months, their score was 0.

Secondary Outcomes: Changes in pain on a VAS (visual analogue scale for pain) estimate, KOOS (knee outcome score), and reports of side effects done at 3 and 6 months.

Statistical Analysis

The analysis was carried out on an intention-to-treat basis. Changes in continuous data over time were analyzed with a repeated measures analysis of variance, while differences in proportions or frequencies were measured by a chi-square analysis. A statistically significant value was set at $p<0.05$.

Results

Table 1: Baseline Demographics

Variable	**PRP group (n=75)**	**CS Group (n=75)**	**p-Value**
Age (years)	61.2 ± 7.5	62.1 ± 7.2	0.62
Female (%)	56%	54%	0.78
BMI (kg/m²)	28.4 ± 3.1	28.7 ± 3.3	0.55

Table 2: Clinical Outcome Measures

Outcome	PRP Group	CS Group	p-Value
WOMAC Score Improvement (6 months)	12.8 ± 3.1	6.2 ± 2.8	<0.001
VAS Pain Reduction (6 months)	3.4 ± 0.9	2.1 ± 1.0	0.02
KOOS Functional Score Improvement	18.5 ± 4.3	10.2 ± 3.6	<0.001

At the six-month mark, PRP was found to be significantly better than corticosteroids for WOMAC, VAS, and KOOS scores.

This study argues that PRP is much better than corticosteroid injections when it comes to managing knee OA. According to the recent literature, PRP reduced the WOMAC scores and pain severity much more than corticosteroids. While corticosteroids provided some relief, the relief only lasted for three months, which is consistent with other studies.

The reason I believe PRP was so effective with the patients is because of its regenerative capabilities that help in cartilage repair by enhancing the proliferation and extracellular matrix synthesis of chondrocytes. Healing inflammation is where corticosteroids shine, but in the long run, they are chondrotoxic. These results, along with others, exhibit the responsiveness to PRP's sustained benefits over corticosteroids.

One limitation is that the follow-up period is still too short, and the patients had too much variability in PRP formulas. Further investigations should determine the most effective PRP preparations and assess effectiveness over the long term in larger groups.

Discussion

The findings of this randomized controlled trial indicate that platelet-rich plasma (PRP) injections result in significantly greater improvements in pain relief and functional outcomes compared to corticosteroid (CS) injections in patients with knee osteoarthritis (OA). These results are consistent with emerging evidence suggesting that PRP offers a more sustained therapeutic benefit due to its regenerative and anti-inflammatory properties.[14] Corticosteroid injections, while widely used for immediate symptom relief, appear to have diminishing effects over time and may contribute to chondrotoxicity with repeated administration.[15]

One of the most notable aspects of this study is the prolonged efficacy of PRP in improving WOMAC, VAS, and KOOS scores. The biological rationale behind PRP's superior efficacy lies in its high concentration of growth factors, including platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), and transforming growth factor-beta (TGF-β). These bioactive molecules promote synovial healing, enhance cartilage matrix synthesis, and modulate inflammation within the joint.[16] Recent meta-analyses have also confirmed that PRP injections lead to sustained pain reduction and functional improvement beyond six months, whereas corticosteroid effects wane significantly after three months.[17]

Another crucial finding is the improved knee function as assessed by KOOS scores. PRP injections facilitated a more significant improvement in daily activities and sports participation, aligning with previous studies demonstrating superior functional outcomes with PRP.[18] This suggests that PRP not only alleviates pain but also enhances overall joint biomechanics, possibly through the modulation of intra-articular cytokine levels and stimulation of endogenous repair mechanisms.[19] In contrast, corticosteroids mainly exert their effects by reducing synovial inflammation and inhibiting inflammatory mediators such as interleukin-1 and tumor necrosis factor-alpha, providing only temporary relief.[20]

The safety profile of PRP was also favorable, with no significant adverse events reported. Previous concerns regarding post-injection flare-ups or transient pain appear to be minimal in this cohort.[21] This aligns with recent evidence suggesting that leukocyte-poor PRP formulations, as used in this study, minimize inflammatory responses while maximizing regenerative potential.[22] On the other hand, corticosteroid injections carry the risk of cartilage degradation with repeated use, reinforcing the need for cautious administration, especially in younger patients.[23]

Despite the promising results, some limitations must be acknowledged. The follow-up duration was limited to six months, and longer-term data would be valuable in assessing the potential disease-modifying effects of PRP. Additionally, variability in PRP preparation protocols across different studies remains a challenge, underscoring the need for standardization in future research.[24] Nevertheless, the current findings contribute to the growing body of evidence supporting PRP as an effective intra-articular therapy for knee OA.

Future studies should aim to investigate the optimal number of PRP injections, ideal PRP composition, and the potential synergistic effects of combining PRP with other regenerative therapies, such as hyaluronic acid. Additionally, cost-effectiveness analyses could help determine the broader clinical implications of PRP as a standard treatment option for knee OA.[25]

Conclusion: This trial confirms that the use of steroid injections on knee osteoarthritis provides less clinical benefit compared to using platelet-rich plasma (PRP) injections. There was improved pain relief, better joint function, and a wide safety margin. These findings suggest that PRP should be used as the primary intra-articular therapy for knee OA, although more studies should be conducted on the long-term results of the treatment and protocols that need to be followed.

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