Intra-Articular Injection of Platelet-Rich Plasma (PRP) in Treatment of Moderate Knee Osteoarthritis: A prospective clinical study

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ABSTRACT

Background: Osteoarthritis (OA) of the knee is a significant contributor to chronic pain and disability. Platelet-rich plasma (PRP) has recently been introduced as a biologic therapy for OA with the aim to reduce pain and potentially retard disease progression. **Objectives:** To analyze the impact of intra-articular PRP injections on decreasing pain and the period required for improving symptoms in patients suffering from knee OA. **Methods:** Three consecutive weekly shots of intraarticular platelet rich plasma injections (IPRPI) were administered to 52 patients. This included 18 bilateral and 34 unilateral knees with radiographic confirmation OA. Pain intensity was assessed using a visual analogue scale (VAS) score at baseline, at 24 hours and after 1 week post injection, and then again at 3 months and 6 months. **Results:** Forty eight (92%) patients had baseline VAS ≥8, worse during the first few hours after injection and improved to ≤3 within a week in all but four patients. Improvement lasted 3 months in 11 patients (Kellgren–Lawrence grade 2-3) and ≥ 6 months in the other 39 patients (KL grade 1-2). In four patients (KL grade 4), pain reduced partially before it returned to baseline pain level at approximately three weeks after the last injection (VAS 9 to 7 then 9 again). **Conclusion:** Injection of PRP has beneficial effects for pain relief based on short to medium term in patients with mild to moderate OA, but its effect appears to be less effective in advanced stages of the disease.

Key words: Intra-Articular, Injection, Platelet-Rich Plasma, Treatment, knee osteoarthritis

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Introduction

Knee osteoarthritis (OA) is a major source of chronic disability worldwide.[1] Osteoarthritis has substantial and growing impact on quality of life, along with high healthcare costs.[1,2] Medical treatment, physical therapy and surgery for end-stage disease are potential treatment options.[3] The use of Platelet-rich plasma (PRP), an autologous blood product containing platelets and growth factors, has been recommended as a biologic therapeutic candidate to reduce pain, improve function and delay disease progression.[4,5]

Globally, OA is prevalent in 528–595 million people and the knee is the most affected joint (365 million persons).[1] The overall prevalence of knee OA among those aged ≥15 years is 16.0% and at the age of ≥40 years it rises to 22.9% worldwide.[1,2,5,6] The ratio of female patients to male patients is approximately 1.7:1 and the prevalence steeply increase after the age of 50.[3,4,8-10] In Africa prevalence of symptomatic knee OA has been found in community and hospital-based studies to range from 9-34% with rates exceeding 21% in Southeastern Nigeria.[6] Akinpelu *et al.*[11] also reported a point prevalence of 21.9% in

females and 19.6% in males (female: male 1.2:1). Report from a hospital-based study at National Orthopaedic Hospital Enugu showed prevalence of 6.5% with female gender and obesity as significant risk factors.[12]

The objectives of this study were to evaluate the analgesic effect and duration of symptom relief following PRP injection in patients with knee OA.

Methods

Study Design and Participants

This was a 2-years prospective study carried out at the University of Maiduguri Teaching Hospital (UMTH) from January 2022 to December 2023. Total of 52 patients with symptomatic knee OA were enrolled consecutively. All participants provided informed consent. The study was approved by the institutional ethics committee. The patients had three PRP injections once every week for three weeks and were followed for six months. Knee radiographs were graded according to Kellgren and Lauren, Table I.

Table I: Kellgren-Lawrence classification of knee osteoarthritis

Grade	Radiographic features
1	No radiographic features of osteoarthritis
2	Doubtful joint narrowing (JSN) and possible osteophytic lipping's
3	Multiple osteophytes, definite JSN, Sclerosis, possible bony deformity
4	Large osteophytes, marked JSN, severe sclerosis and definite deformity

The sample size was calculated based on the primary outcome measure of VAS pain score at 6 months. Based on previous studies,[1,3] we anticipated a mean reduction in VAS score of 3.5 points (SD=1.8) following three PRP injections. Using a two-tailed paired t -test with α=0.05 and power of 80%, the required sample size was calculated for 45 patients. Accounting for an anticipated dropout rate of approximately 5%, we recruited 52 patients to ensure adequate statistical power for the primary analysis. Sample size calculation was performed using G power software version 3.1.

A structured proforma was used to gather the sociodemographic data, pattern of knee joint involvement, among others. Results were described in text and tables.

Platelet-rich plasma preparation and injection technique

Twenty (20) ml of venous blood was drawn from each patient into four EDTA containers (5ml in each) and centrifuged for 5-10 minutes at 2500 to 3000 rpm to obtain plasma. The plasma was collected from the bottom layer of the supernatant without disturbing the buffy coat. When injecting a single knee, 0.5mls was taken from each EDTA bottle making 2mls from the four. For bilateral knees, 1ml from each bottle was taken making 2mls in two different syringes. Patients sit on a couch or on a chair with knees at 90 degrees. The knee was cleaned with povidone iodine and draped (aseptic technique). Inferior lateral aspect of the knee just lateral to inferior pole of patella was palpated, needle passed at 90 degrees freely into the joint, angled to 45 degrees and the whole content of the syringe (2mls of PRP) is injected into the joint. Sterile gauze with plaster was applied and patients were asked to ice the site at home with occasional paracetamol when the need arises, no NSAIDS was given. This procedure was repeated weekly for three consecutive weeks, VAS score was done before each injection, then weekly for three weeks (until completion of three doses), then after three months, and after six months.

Data analysis was carried out using SPSS version 23. Descriptive statistics included means, medians, standard deviations, and ranges. A p-value of less than 0.05 was considered statistically significant.

Results

A total of fifty-two (52) patients between the ages of 40 to 68 years with knee OA who attended the UMTH Orthopaedic clinic from January 2022 to December 2023 were recruited and administered PRP injection after getting their informed consent.

The mean age ±SD of the study population was 57.31 ± 7.67years, and the median age was 59.0 years. The gender distribution of the study participants is shown in figure 1, and the male to female ratio was 0.73:1.

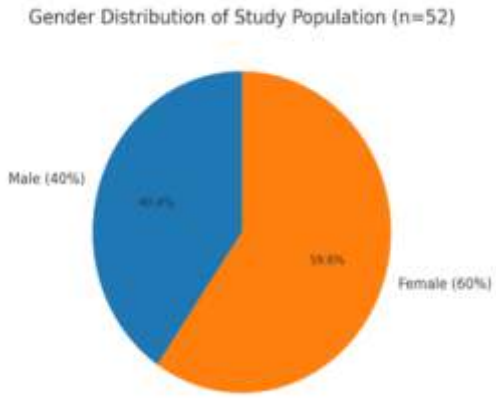

Figure 1: Gender distribution

In majority of the patients studied, the right knee was the one affected, the laterality of the knee affected is shown in figure 2.

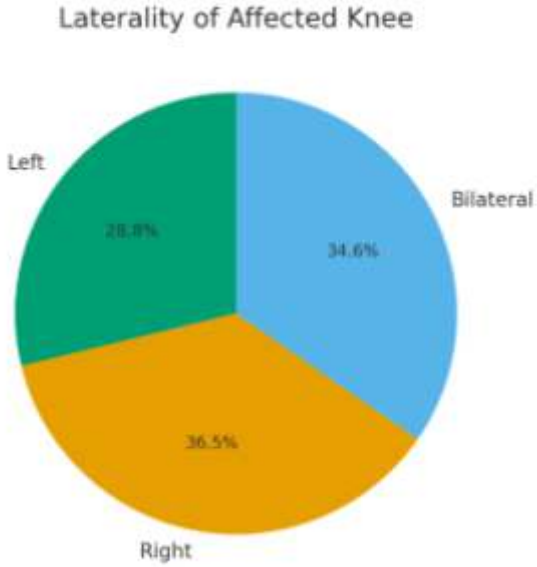

Fig. 2: Pie chart showed involvement or laterality of the knees.

The Kellgren- Lawrence grade and corresponding duration of pain relief with intraarticular injection of PRP is as shown in table II.

Table II: Kellgren- Lawrence grade and corresponding duration of pain relief

KL Grade	No. of patients	pain relief duration
Grade 1	4	≥ 6 months
Grade 2	33	≤6 months
Grade 3	11	3 months
Grade 4	4	≤ 3 weeks

VAS scores decreased significantly from baseline (mean 9.0 ± 1.07) to six months (mean 4.0 ± 0) $p < 0.001$ which is significant, (figure 4).

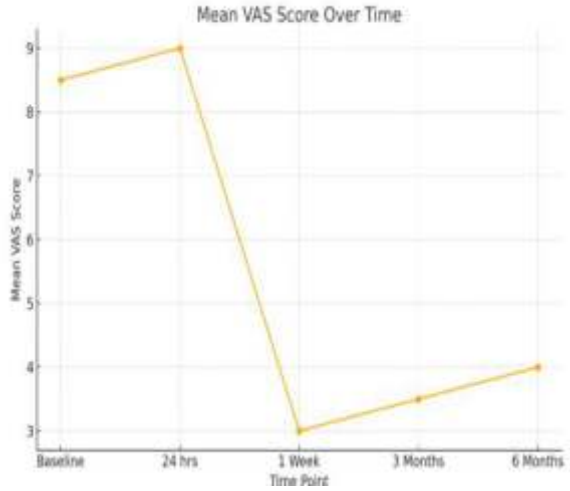

Fig. 4: VAS Score

Discussion

Knee osteoarthritis is a chronic degenerative joint disorder with biochemical and biomechanical alterations including degradation of articular cartilage, joint edge deterioration leading to stiffness, and limitation of mobility.[14] Recently, PRP injection has been explored as a chondro-protective treatment for symptomatic knee osteoarthritis.[8]

A study by Yadav R *et al* stated that the greatest increase in incidence of knee OA occurs between the ages of 35-39, and 40-49 age group. The study suggested that middle age represents a critical period of OA development.[1]

M.B Shinde *et al* in another study of the relationship between radiographic features of OA by Kellgren and Lawrence and pain showed that the common age group for OA was between 51-60 years.[15] A similar study in Saudi Arabia by M. Elbashir *et al* showed the common age group is in those older than 58years, followed by 48-58years.[16] The age groups of

patients with OA in these studies are similar to our study. The male to female ratio found in this study is similar to studies by J. Di *et al* and S. Ji *et al*.[17]

The laterality of the knee OA in this study is in keeping with findings of other studies. In a study of 100 patients, Yan J *et al* found more OA on the right knee with 62%, and 38% on the left[18] . Study by Irshad *et al* found more OA affecting both knees in approximately 86.2% and only 13.8% in unilateral cases.[19]

Relationship between Kallgren and Laurence grading and duration of pain relief after PRP injection was reported in our study; thus, patients with grade 1 KL (N=4) had symptoms of pain relief for greater than six (6) months. Grade 2 KL Patients (N=33) had pain relief for six (6) months and below. Grade 3 (N=11) had pain relief up to three (3) months and grade 4 (N=4) had pain relief for less than three (3) months. This is like the study by Peng YN *et al* who studied 212 patients with Kellgren-Lawrence grades 1-3 knee osteoarthritis treated with high dose PRP injection. Baseline VAS decreased significantly to 3, 4, and 12 months of follow-up. Kellgren-Lawrence grade 2 had most favourable pain reduction with lower VAS score recorded at 6 months post injection.[9]

Our findings showed that PRP injections may reduce pain in mild to moderate OA, with patients reporting sustained improvement in pain relief for up to six months. Within the first 24 hours after injection, pain worsened (see fig. 4) this could be explained by localized inflammation; this is in keeping with findings in other studies,[14-16] the factor that will likely affect or reduce the effectiveness of PRP injection in KL 4 is the degree of joint destruction. However, a study of 50 patients with knee OA done by Park YB et al showed that there was consistent pain reduction across all KL grades throughout the post injection period.[20]

VAS Score showed significant decline in our study from 9.0+1.07 to 4.0 over six months, underscoring the analgesic effect of PRPI. This is supported by other studies that emphasized the pain-relieving properties of platelet-derived bioactive molecoules.[1-3,13] A meta-analysis by Romandini *et al* suggested that PRPI Pain reduction may stem from its ability to modulate inflammatory mediators such as prostaglandin E2 and substance P, and its enhanced cartilage matrix synthesis via growth factors.

In another study by Romandini *et al* on patients with KL 2 and 3, they found out that baseline VAS Score improved from 7.0+1.2 to 2.76+ 1.34 at 12 months post treatment($p<0.05$).

Limitation:

Limitations of this study include lack of a control group preventing direct comparison with placebo or alternative treatments. Number of injections was also fixed; we could not assess the differential effects of single versus multiple injections. While the six-month follow-up showed clear improvement, long-term outcomes remain uncertain. Study strength includes good sample size, strict inclusion criteria, and the use of a validated scoring system. (VAS).

Conclusion:

PRP injection using this standardized technique is a safe and effective adjunct for knee OA management, particularly in KL grade 1–3. Its limited efficacy in KL grade 4 suggests careful patient selection is key for optimal outcomes.

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