

## Efficacy of Platelet-Rich Plasma (PRP) Injections for Knee Osteoarthritis

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### ABSTRACT

**Introduction:** Osteoarthritis (OA) is a degenerative joint disease affecting millions of people worldwide, with knee OA being the most common form. The management of knee OA includes a combination of non-pharmacological and pharmacological treatments, and surgery may be required in severe cases. This study aimed to determine efficacy of PRP injections for knee osteoarthritis treatment. **Methods:** This cross-sectional study was conducted at the Department of Medicine and Orthopedics at North Bengal Medical College and Hospital, Sirajganj, Bangladesh, from July, 2021 to December, 2022. A total number of 120 patients with knee osteoarthritis (OA) were enrolled for this study on the basis of selection criteria. All the patients were treated with Platelet-rich plasma (PRP) injection for ten months. Patients were evaluated using the Visual Analogue Scale (VAS) at four injection points. **Results:** Most (71, 59.17%) patients were within 40-80 years of age with a mean age of  $59.06 \pm 8.78$  years. Male (103, 85.83%) patients were predominant. VAS scores declined with subsequent PRP injections, indicating pain reduction. After treatment, 33.33% reported moderate to severe pain, 30% mild pain, and 25% were pain-free. No individuals reported the worst pain (score of 10). MRI image shows knee joint improvement after PRP therapy. **Conclusion:** PRP injections for knee osteoarthritis (OA) show decreased pain levels and improved joint condition over successive treatments, as indicated by Visual Analogue Scale scores and MRI images.

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### INTRODUCTION

Osteoarthritis (OA) is a degenerative joint disease resulting from the breakdown of joint cartilage and underlying bones.<sup>1,2</sup> It is the fourth leading cause of disability in the

world.<sup>3</sup> Joint pain and stiffness are the most common symptoms.<sup>4</sup> Usually, the symptoms progress slowly over the years. Other symptoms include joint swelling and decreased range of movement.<sup>4</sup> The symptoms can interfere with

work and normal daily activities. Osteoarthritis is the most common arthritis, affecting about 237 million people in the world in 2015.<sup>5,6</sup> Approximately one in seven Americans suffers from OA.<sup>2</sup> It is more commonly found in advanced-aged people.<sup>4,7</sup> Prevalence of osteoarthritis in Bangladesh was 7.3% in 2022.<sup>8</sup> Platelet-rich plasma (PRP) is a concentrated solution of platelets derived from the patient's blood, which contains growth factors and other bioactive molecules that can potentially promote tissue regeneration and reduce inflammation. PRP's intra-articular injection (IAI) has been extended to manage knee OA in recent years due to its easy preparation and administration and fewer adverse effects.<sup>9</sup> Autologous conditioned plasma, also known as PRP, is a concentration of platelet-rich plasma proteins derived from whole blood after removing red blood cells. It is used for treating various medical conditions like OA but efficacy is controversial.<sup>10,11</sup> However, some studies have considered using IAI as a first-line treatment because it has proven effective in relieving pain with fewer adverse effects than some oral medications.<sup>12</sup> PRP is suggested to be more effective in patients with a lower degree of cartilage degeneration than in severe cases or higher OA grade.<sup>13</sup> PRP includes various growth factors whose properties differ significantly. Its anabolic ability to induce chondrocyte differentiation is a valuable characteristic for managing OA. Anabolic growth factors included in PRP are transforming growth factor beta 1 (TGF-β1), platelet-derived growth factor (PDGF), insulin-like growth factor 1 (IGF-1), vascular endothelial growth factor (VEGF), human growth hormone, and essential fibroblast growth factor (bFGF).<sup>14</sup> Despite the growing interest in PRP therapy for knee OA, there is still much debate over its effectiveness. This study aimed to determine PRP injections' efficacy for knee osteoarthritis treatment.

**METHODS**

This cross-sectional study was conducted at the Department of Medicine and Orthopedics at North Bengal Medical College and Hospital, Sirajganj, Bangladesh. One hundred twenty patients with knee osteoarthritis (OA) with very severe pain were enrolled purposively for this

study from July, 2021 to December, 2022. All 120 OA patients were treated with Platelet-rich plasma (PRP) for ten months. Informed written consent was taken from each participant. Inclusion criteria were chronic history (for at least four months) of knee joint pain, radiographically documented knee osteoarthritis of grade 1 to 3 (Kellen-Lawrence K-L radiographic classification scale). Exclusion criteria were radiographically severe knee osteoarthritis of grade 4 (K-L radiographic classification scale), history of previous femur and tibia fractures, knee surgery (e.g., arthroscopy), and hyaluronic acid infiltration in the previous six months, hemoglobin levels <10 g/dl and a history of hematological disease, infections, or immuno suppression.

All the patients were well informed about clinical evaluation before starting the procedure at each visit, and routine blood tests were carried out before injection, including a complete blood count and screening for transmissible diseases (e.g., HIV, HBV, and HCV). All tests were performed in the same laboratory.

The platelet-rich plasma (PRP) was given to the patients four times as an injection for ten months. The evaluation times were:

- T0 (First injection at the time of recruitment).
- T1 (Second injection after one month of first injection).
- T2 (Third injection after three months of second injection).
- T3 (Fourth injection after six months of the third injection).

All the patients were advised for 10 hours fasting before the blood collection to avoid any effect of food on PRP concentrate, but water intake was not restricted. Visual Analogue Scale (VAS) was used to evaluate the study outcome.<sup>15</sup> Patients were also analyzed based on MRI images from baseline to the end of treatment.

**Visual Analogue Scale (VAS):**

Score	Pain status
0	No pain
1-3	Mild
4-6	Moderate-severe
7-9	Very severe
10	Worst pain

All data were presented in a suitable table or graph according to their affinity. All statistical analysis was performed using the Statistical Package for Social Science (SPSS) program, version 26.

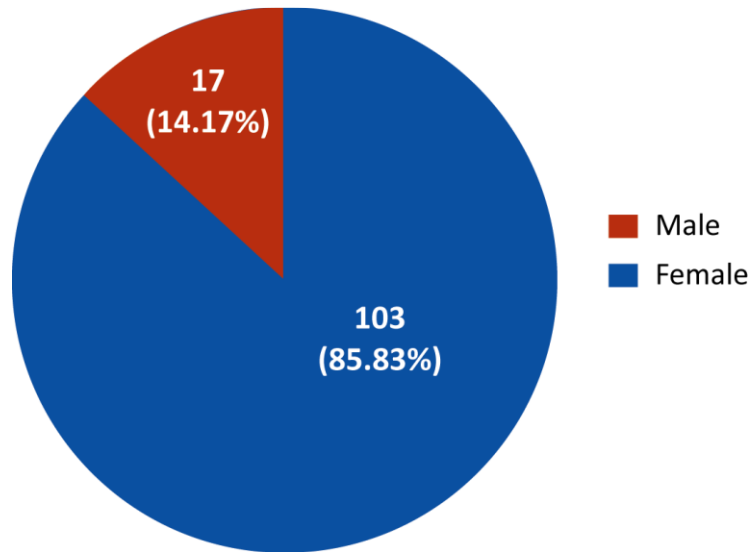
**Table I: Age distribution of the patients (n-120).**

Age (year)	Frequency	Percentage	Mean±SD
40-59	30	25	
60-79	71	59.17	59.06±8.78
≥80	19	15.83	
<b>Total</b>	<b>120</b>	<b>100</b>	

**RESULTS**

Most (70, 59.17%) of the patients were aged between 40-80 years and mean of age was 59.06±8.78 years (Table I).

Predominant (103, 85.83%) sufferer of knee osteoarthritis were male (Figure 1).

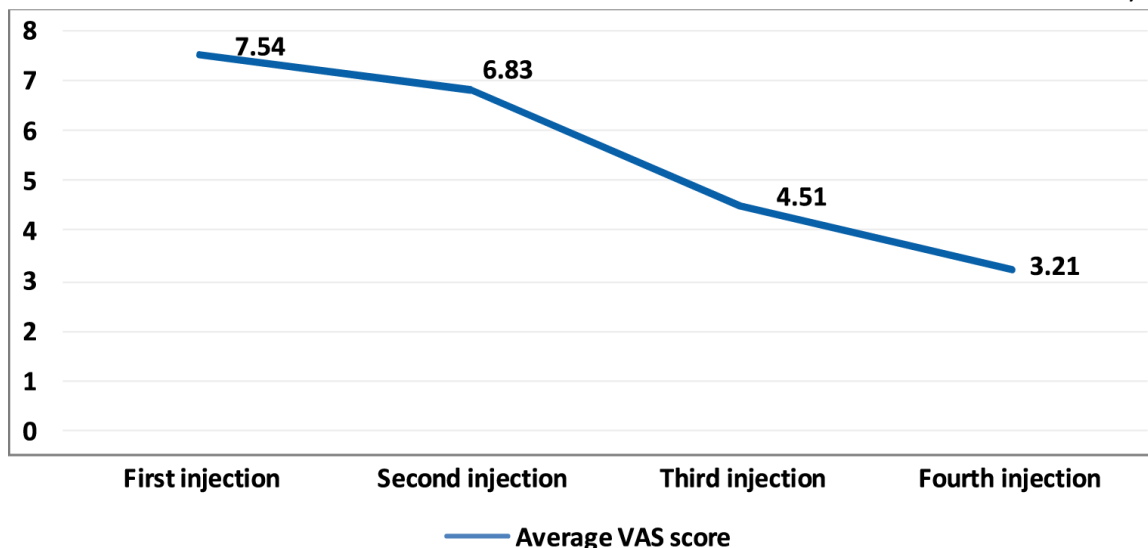


**Figure 1: Sex distribution of the patients (n-120).**

Majority of the patients had normal BMI and mean was 25.4±3.9 (Table II).

**Table II: Body Mass Index (BMI) status of the patients (n-120).**

BMI (kg/m2)	Frequency	Percentage	Mean±SD
Underweight (<18.5)	17	14.17	
Normal (18.5-24.9)	45	37.50	
Overweight (25-29.9)	28	23.33	25.4±3.9
Obesity (≥30)	30	25.00	
<b>Total</b>	<b>120</b>	<b>100</b>	



**Figure 2: Efficacy of PRP therapy according to VAS score**

Figure 2 presents data on the average VAS (Visual Analogue Scale) scores recorded after a series of injections during 10 months of treatment. Following the first injection, the average VAS score is notably high at 7.54. However, a decline in the score is observed with subsequent injections. After the second injection, the average

VAS score drops to 6.83. This downward trend continues more sharply after the third injection, with the score falling to 4.51. The lowest average VAS score is recorded after the fourth injection, at 3.21. This pattern suggests a progressive decrease in the VAS scores with each successive injection.

**Table III: Clinical outcome of the patients based on VAS score**

Outcome	Frequency	Percentage
No pain (0)	30	25.00
Mild (1-3)	36	30.00
Moderate-severe (4-6)	40	33.33
Very severe (7-9)	14	11.67
Worst pain (10)	0	0.00

The table III presents data on the distribution of pain intensity among individuals categorized into five levels after treatment. The largest group, consisting of 40 individuals (33.33%), reported experiencing moderate to severe pain and 36(30%) had mild pain. Twenty-five percent of the patients had no pain after ten months and four PRP injections. No individuals reported experiencing the worst possible pain. After PRP injection osteophytes are reduced and joint space is maintained (Figure 3).



**Figure 3: MRI image of keen joint before (A) and after (B) PRP injection (arrow marked)**

## DISCUSSION

The results of this study highlight that PRP infiltrations represent a beneficial conservative treatment to reduce pain and improve quality of life over 10-month follow-up in patients with knee osteoarthritis. Our study comprised 120 patients with OA-affected knee joints, examined clinically, radiographically. The benefits of PRP injection in joint disease are demonstrated by several authors.<sup>15-18</sup> The VAS indicated positive effects were shown in patients with decreasing pain. A statistically significant subjective and objective improvement of the VAS scale was demonstrated previously.<sup>19</sup> The effects of PRP injection on pain reduction have been previously observed in other studies, and several authors have reported the analgesic properties of platelets.<sup>20-22</sup> More recently, a meta-analysis indicated that PRP reduces pain by influencing the expression of mediators (e.g., prostaglandin E2, substance P, dopamine, 5-hydroxy-tryptamine) and that the GFs contained in the PRP concentrate promote the synthesis of cartilage matrix, stimulating the growth of chondrocytes and the inhibition of the local inflammatory response.<sup>23,24</sup> Tang et al.<sup>25</sup>, in their meta-analysis, found the differences between osteoarthritis treatments with PRP versus Hyaluronic acid. Compared with acid hyaluronic, PRP has more significant benefits in the conservative treatment of knee osteoarthritis, such as less long-term discomfort and better knee joint function. PRP shows no additional risks and maybe a conservative treatment for knee osteoarthritis. Patients with knee osteoarthritis who received PRP intra-articular injections had the best overall success compared to steroids, hyaluronic acid, and placebo at 3, 6, and 12-month follow-ups.<sup>26</sup> Cavazos et al.<sup>27</sup> suggest that while single and multiple PRP injections improved pain and there was no difference, triple PRP injections were more effective than single injections in enhancing joint functionality in individuals with knee OA. Moreover, different APCs (Autologous platelet concentrates) were used in regenerative and reparative medicine. For instance, advanced platelet-rich fibrin+ (A-PRF+) and leucocyte platelet-rich fibrin protocol (L-PRF) demonstrated control of bleeding and promoted injured tissue

healing.<sup>28</sup> Platelet concentrate without anticoagulants (i-PRF) strongly influenced osteoblast behavior by influencing human osteoblast migration, proliferation, and differentiation.<sup>29</sup> Following the first injection, our study's average VAS score is notably high at 7.54. However, a decline in the score is observed with subsequent injections. After the second injection, the average VAS score drops to 6.83. This downward trend continues more sharply after the third injection, with the score falling to 4.51. The lowest average VAS score is recorded after the fourth injection, at 3.21. Previous studies also support our pain management treatment using PRP.<sup>30,31</sup> This pattern suggests a progressive decrease in the VAS scores with each successive infusion. MRI image shows improvement after ten months of PRP therapy. A previous study by Singh AP et al.<sup>19</sup> found improvements in treated OA using PRP. According to VAS, the PRP therapy's efficacy in OA shows excellent response in 25% of patients with no pain, 30% with mild pain, and 33.33% with moderate-severe pain. Dório et. al.<sup>32</sup>, found pain intensity using PRP in 30% of mild pain cases and 35% of moderate pain outcomes. This study on Platelet-Rich Plasma (PRP) injections for knee osteoarthritis (OA) highlights several limitations. It is a single-center study from Bangladesh, limiting generalizability. The sample size of 120 patients may need to represent KOA diversity adequately, affecting statistical power. The ten-month duration might not capture long-term outcomes or treatment response variations. Lack of a control group hampers comparing PRP efficacy against standard treatments. Additionally, using the Visual Analogue Scale (VAS) for pain assessment introduces subjective bias. These limitations stress the necessity for more extensive, multicenter randomized trials with longer follow-ups to comprehensively validate PRP's efficacy and safety in knee OA management.

## CONCLUSION

This study concluded that, PRP injection is effective for pain reduction in knee osteoarthritis patients over ten months of treatment. So, it may be an alternative to traditional pain management.

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**Conflict of interest:** None

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