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The Role of Platelet-rich Plasma in Osteoarthritis of Knee-joint

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Abstract **Background:** Osteoarthritis is one of the leading causes of disability. Platelet-rich plasma (PRP) is known as autologous conditioned plasma is a concentrate of platelet-rich plasma protein derived from whole blood, centrifuged to remove red blood cells. Now it is used in treating OA. We have very few data regarding this issue. The aim of this study was to assess the role of platelet-rich plasma in osteoarthritis of knee-joint. **Materials and methods:** This was a prospective observational study which was conducted at the Department of Orthopaedics & Traumatology, Bangabandhu Sheikh Mujib Medical University (BSMMU) Dhaka, Bangladesh during the period from January 2018 to December 2018. In total 89 patients, diagnosed with grade I and II arthritis were included in this study as the study population. To all the participants three PRP injections were injected in the knees at 4-week interval. Patients were followed up and were assessed for pain and physical activity associated with arthritis using the Western Ontario and McMaster University Arthritis Index (WOMAC) score at the time of induction in the study and at 6 months interval. **Results:** The mean (±SD) WOMAC score of the participants was 82.94 (±5.12) at the baseline whereas it was found 37.87 (±4.73) at the follow up period after 6 months. After 6 months the mean (±SD) WOMAC score of male participants was found 36.93 (±5.71) and it was found 38.87 (±5.39) among female participants. This difference was statistically significant (P=0.021). Besides this, after 6 months the mean (±SD) WOMAC score of Kellgren–Lawrence grade-1 participants was 37.68 (±5.44) and it was found 40.13 (±5.01) among Kellgren–Lawrence grade-2 participants. This difference was statistically significant (P=0.002). Moreover, after 6 months the mean (±SD) WOMAC score of participants with ≤2 years duration of symptoms was 37.95 (±5.37) and it was found 41.66 (±4.28) among participants with >2 years duration of symptoms. This difference was extremely statistically significant. **Conclusions**: The proper sequential use of PRP injection for the treatment of osteoarthritis of knee-joint proved to be effective in our study. We recommend its wide use in the treatment of osteoarthritis of knee-joint.

Keywords: *osteoarthritis, Platelet-rich plasma (PRP), knee joint, orthopedics*

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1. Introduction

Osteoarthritis (OA) is the most common articular disease of the developed world and a leading cause of chronic disability, mostly as a consequence of knee OA and/or hip OA [1]. OA affects the knee more often than any other joint [2]. With the ageing of the population and the growing obesity epidemic, the number as well as the frequencies of surgical procedures for knee with OA will increase dramatically in the coming years. In medication knee replacement is the costliest treatment procedure in health care system and burdensome for the patients also. OA is the most common articular disease that results from defects in articular cartilage. It affects significantly the quality of life and it is one of the main causes for musculoskeletal disability. [3] Osteoarthritis can affect any joint but mostly seen in knees, hip, hands, facet joints, and feet. [4] With advancing age, there is increase in the prevalence of symptomatic knee osteoarthritis with the annual incidence being highest in people aged between 55 years and 64 years among the US population. [5] Osteoarthritis is not merely a process of cartilage wear and tear. Rather, it is a complex disease characterized by secretion of inflammatory mediators such as inflammatory cytokines which are claimed to play a leading role in the pathophysiology of this debilitating disease. [6] In a normal joint, generally chondrocytes remain inactive with very small turnover of the cartilage matrix. In osteoarthritis, stimulation of extra cellular matrix receptors over chondrocytes transforms them into

activated chondrocytes. They exhibit cellular proliferation and cluster formation and produce matrix degrading proteinases and inflammatory cytokines. [6] In addition to cartilage destruction, osteoarthritis is also characterized by synovial inflammation, subchondral sclerosis, ligament laxity, and osteophyte formation. [7] The series of these pathological changes in all joint tissues led to the consideration of osteoarthritis as a disease of joint as an organ. [6] There have been a number of supportive treatments for osteoarthritis including analgesics, viscosupplements, and corticosteroids that are used to alleviate the symptoms of arthritis. [8] Recently, there is increase in the use of platelet-rich plasma (PRP) for the treatment of osteoarthritis. PRP derived from autologous blood containing growth factors is claimed to activate the healing process in damaged cartilage and helps in tissue regeneration. [9] Recent research has identified a number of key biochemical pathways that could be targeted therapeutically through biological intervention [10]. PRP is an autologous concentration of human platelets in a small volume of plasma, where the platelet concentration is higher (Typically up to five times higher) than the normal platelet concentration in a healthy person's blood. Emerging evidence suggests PRP has the potential to have a regenerative effect on certain body tissues, in addition to the main role platelets play in haemostasis [11]. PRP has been shown to provide some symptomatic relief in early OA of the knee and to be at least as effective as intra-articular hyaluronic acid and steroid injections for symptom control [12]. This therapy is a minimally invasive intervention which could be used to enhance tissue re-generation. PRP contains alpha granules, in which about 70% of their growth factors will be secreted in the first 10 min, and almost all the stored amount will be released in the first hour [13]. As in the treatment of osteoarthritis of knee-joint uses of platelet-rich plasma is a newly introduced procedure in Bangladesh we have very limited research-based data regarding this issue.

2. Methodology and Materials

This prospective observational study was conducted at the Department of Orthopaedics & Traumatology, Bangabandhu Sheikh Mujib Medical University (BSMMU) Dhaka, Bangladesh during the period from January 2018 to December 2018. In total 89 patients diagnosed with grade I and II arthritis were included in this study as the study population. To all the participants three PRP injections were injected in the knees at 4-week interval. Patients were followed up and were assessed for pain and physical activity associated with arthritis using the Western Ontario and McMaster University Arthritis Index (WOMAC) score at the time of induction in the study and at 6 months interval. All patients were diagnosed with grade I and II (Kellgren–Lawrence) [14] osteoarthritis, symptoms and Western Ontario and McMaster University Arthritis Index (WOMAC) score. [15] Dhurat and Sukesh [16] described two methods for preparation of PRP using differential centrifugation, namely PRP method and buffy-coat method. We utilized PRP method in our study group. Patients were registered with the Orthopedic Department of mentioned hospital and PRP was prepared at Hematology Department of the same hospital. Blood was drawn from patient's cubital vein to make 4-6 mL of PRP. Blood samples were collected in bags containing anticoagulant (citrate phosphate dextrose and adenine). The collected blood samples were then transferred into a tube and centrifuged at a constant acceleration to separate the red blood cells (RBCs) from whole blood volume. It separates blood in three layers (platelets with white blood cells: WBCs, buffy coat rich in WBCs, and RBCs from top to bottom). Then, the upper layer and superficial buffy coat are centrifuged again in a new sterile tube sufficient enough to form soft pellets at the bottom. Upper two thirds of this centrifuged volume is discarded, while the remaining lower one third is homogenized to make PRP. The PRP was dispensed in a sterile syringe. Patients were given appointment in Outpatient Department (OPD) for PRP injection. Under aseptic technique, PRP was injected in the knees through supra-lateral approach in supra-patellar pouch. After given with injection, patients were observed for 20 min and discharged home with clear instructions for signs of infection including increasing pain, redness, warmth, and inability to bear weight. Patients were prescribed paracetamol in case of pain and advised not to take non-steroidal anti-inflammatory drugs (NSAIDs) and steroids. Patients were followed up in OPD on regular basis. A total of three injections were given to each patient at 4 weeks interval. WOMAC score was calculated at the time of induction in the study and at 6 months interval to assess the effect of PRP injection. Data were presented as frequencies. WOMAC score at the start of treatment was compared with the final scores. All data were processed, analyzed and disseminated by MS Office and SPSS version 20 as per need.

3. Results

In this study the total participants were 89 in number who had completed the full tenure of this intervention. The mean age of the patients was 48.36 (+6.72) years. In analyzing the gender of the participants of this study we found that, among 89 participants, 37% (n=33) were male and 63% (n=56) were female. So female was dominating in number and the male-female ratio was 1:1.7. In analyzing the ages of the participants, we observed, the highest number of participants were from 41-50 years' age group which was 37.08%. Besides this, 6.74%, 26.97%, 23.60% and 5.62% participants were from <30, 31-40, 51-60 and >60 years' age groups respectively. The mean (±SD) WOMAC score of the participants was 82.94 (±5.12) at the baseline whereas it was found 37.87 (±4.73) at the follow up period after 6 months. This development was extremely statistically significant where the p value was less than 0.0001. On the other hand, after 6 months the mean (±SD) WOMAC score of male participants was found 36.93 (±5.71) whereas it was found 38.87 (±5.39) among female participants. This difference was statistically significant where the p value was 0.021. Besides this, after 6 months the mean (±SD) WOMAC score of Kellgren–Lawrence grade-1 participants was found 37.68 (±5.44) whereas it was found 40.13 (±5.01) among Kellgren–Lawrence grade-2 participants. This difference was statistically significant where the p value

was 0.002. Moreover, after 6 months the mean (±SD) WOMAC score of participants with ≤2 years duration of symptoms was found 37.95 (±5.37) whereas it was found 41.66 (±4.28) among participants with >2 years duration of symptoms. This difference was extremely statistically significant where the p value was less than 0.0001.

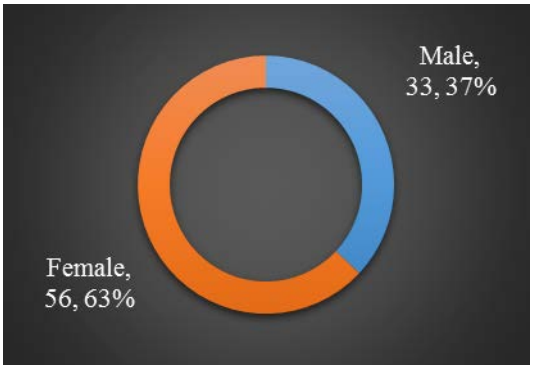

Figure 1. Gender distribution of participants (n=89)

Table 1. Age distribution of participants (n=89)

Age (Year)	n	%
<30	6	6.74
31-40	24	26.97
41-50	33	37.08
51-60	21	23.60
>60	5	5.62
Total	**89**	**100**

Table 2. Difference between WOMAC score at the baseline of treatment and at 6 months follow-up (n=89)

Period	Mean	SD	P value
Baseline	82.94	5.12	0.0001
After 6 months	37.87	4.73	

Table 3. Comparison of WOMAC score after 6 months between subgroups (n=89)

Gender			
Male	36.93	5.71	0.021
Female	38.87	5.39	
Kellgren–Lawrence grade			
Grade-1	37.68	5.44	0.002
Grade-2	40.13	5.01	
Duration of symptoms			
≤ 2 Years	37.95	5.37	0.0001
> 2 Years	41.66	4.28	

4. Discussion

The aim of this study was to assess the role of platelet-rich plasma in osteoarthritis of knee-joint. In this current study, we observed remarkable clinical improvement among patients with arthritis who received PRP injection. Difference in WOMAC score at 6 months interval was significant. Patients having symptoms for less than 2 years showed more improvement in WOMAC score. Unfortunately, in our study, we did not have any comparative group with other mode of treatment. But in the literature, there are some comparative studies and meta-analyses favoring the use of osteoarthritis is a debilitating disease affecting the mobility and quality of life among individuals. Nonsurgical treatments including PRP, corticosteroids, and hyaluronic acid have been prescribed by physicians with good short-term results. There has been increasing interest in biological and regenerative methods including PRP. [14] However, it is to be noted that any invasive procedure may have some placebo effect. A recent systematic review and meta-analysis by Sadabad et al. showed superior efficacy for PRP as compared to hyaluronic acid in alleviating the clinical symptoms over a period of 2 years. However, they recommended the need of long-term studies for the effects of PRP. [12] Another systematic review by Khoshbin et al. shows that multiple sequential PRP injections have better symptomatic relief as compared to hyaluronic acid or normal saline solution at 6 months follow-up. [15] In our study also we found significant improvement in the WOMAC score in patients with PRP injections at 6 months interval. PRP therapy is minimally invasive and a simple alternative, being used to enhance the healing process and tissue regeneration. It has the potential to improve the quality of life, relieve pain, and enhance knee joint function. [16] Kon et al. studied the effects of PRP injection in the treatment of chronic degenerative condition of the knees. They studied the effects in 115 patients at 6- and 12-months follow-up. There was an overall significant improvement at 6- and 12-months interval. However, they observed that in the initial 6 months, the results were stable; in the second half (7–12 months), the results became worse at 12 months as compared to the first 6 months. In addition, the results were better in patients with early grade of arthritis. [17] In our study, we had favorable results at 6 months, but our overall study duration was shorter. Secondly, we had selected patients with early arthritis (Kellgren grade 1 and 2). Jang et al. presented the outcome of his 65 patients who were treated with PRP injection. There was improvement in Visual analogue scale (VAS) and International Knee Documentation Committee (IKDC) scores; however, the developing degeneration in the joint had been associated with reduced clinical effects of PRP. The results were better in younger age-group with early osteoarthritis. [18] In our study, the study group was relatively younger with early arthritis and showed significant improvements at 6 months follow-up. Patel et al. compared the effects of PRP in three sub- groups and concluded that there was a significant improvement in patients receiving either single (group A) or two (group B) PRP injections. The third group (group C), received normal saline instead of PRP, showed deterioration of symptoms. Mild complications including nausea and dizziness were observed in some patients but for shorter duration. [19] In our study, unfortunately, there was no comparison group, but PRP injection showed significant clinical improvement. Mild hyperemia was observed in three patients but managed conservatively.

5. Conclusion and Recommendations

The proper sequential use of PRP injection for the treatment of osteoarthritis of knee-joint proved to be effective in our study. The findings of this study may be

helpful in the treatment arena of osteoarthritis and in further similar researches. We recommend its wide use in the treatment of osteoarthritis of knee-joint. But this was a single centered study with a small sized sample. So, the findings of this study may not reflect the exact scenario of the whole country. For getting more reliable information we would like to recommend for conducting more studies in several places with larger sized samples.

References

[1] Wright Neogi T, Zhang Y. Epidemiology of osteoarthritis. Rheum Dis Clin N Am. 2013; 39(1): 1-19.

[2] Duymus TM, Mutlu S, Dernek B, Komur B, Aydogmus S, Kesiktas FN. Choice of intra-articular injection in treatment of knee osteoarthritis: platelet-rich plasma, hyaluronic acid or ozone options. Knee Surg Sports Traumatol Arthrosc. 2017; 25(2): 485-92.

[3] Raeissadat SA, Rayegani SM, Babaee M, et al. The effect of platelet-rich plasma on pain, function, and quality of life of patients with knee osteoarthritis. Pain Res Treat 2013; 2013: 165967.

[4] Litwic A, Edwards MH, Dennison EM, et al. Epidemiology and burden of osteoarthritis. Br Med Bull 2013; 105: 185-199.

[5] Deshpande BR, Katz JN, Solomon DH, et al. Number of persons with symptomatic knee osteoarthritis in the US: impact of race and ethnicity, age, sex and obesity. Arthritis Care Res (Hoboken) 2016; 68(12): 1743-1750.

[6] Kapoor M, Martel-Pelletier J, Lajeunesse D, et al. Role of proinflammatory cytokines in the pathophysiology of osteoarthritis. Nat Rev Rheumatol 2011; 7(1): 33-42.

[7] Martel-Pelletier J, Boileau C, Pelletier JP, et al. Cartilage in normal and osteoarthritis conditions. Best Pract Res Clin Rheumatol 2008; 22(2): 351-384.

[8] Michael JW, Schlu¨ter-Brust KU, and Eysel P. The epidemiology, etiology, diagnosis, and treatment of osteoarthritis of the knee. Dtsch Arztebl Int 2010; 107(9): 152-162.

[9] Smyth NA, Haleem AM, Ross KA, et al. Platelet-rich plasma may improve osteochondral donor site healing in a rabbit model. Cartilage 2016; 7(1): 104-111.

[10] Patel S, Dhillon MS, Aggarwal S, Marwaha N, Jain A. Treatment with platelet- rich plasma is more effective than placebo for knee osteoarthritis: a prospective, double-blind, randomized trial. Am J Sports Med. 2013;41(2):356-64.

[11] Lee KS, editor. Platelet-rich plasma injection. Seminars in musculoskeletal radiology. New York: Thieme Medical Publishers; 2013.

[12] Lana JFSD, Weglein A, Sampson SE, Vicente EF, Huber SC, Souza CV, et al. Randomized controlled trial comparing hyaluronic acid, platelet-rich plasma and the combination of both in the treatment of mild and moderate osteoarthritis of the knee. J Stem Cells Regen Med. 2016; 12(2): 69-78.

[13] Spakova T, Rosocha J, Lacko M, Harvanova D, Gharaibeh A. Treatment of knee joint osteoarthritis with autologous platelet-rich plasma in comparison with hyaluronic acid. Am J Phys Med Rehabil. 2012;91(5):411-7.

[14] Andia I, Sa´nchez M, and Maffulli N. Joint pathology and platelet-rich plasma therapies. Expert Opin Biol Ther 2012; 12(1): 7-22.

[15] Khoshbin A, Leroux T, Wasserstein D, et al. The efficacy of platelet-rich plasma in the treatment of symptomatic knee osteoarthritis: a systematic review with quantitative synth- esis. Arthroscopy 2013; 29(12): 2037-2048.

[16] Filardo G1, Kon E, Buda R, et al. Platelet-rich plasma intra-articular knee injections for the treatment of degenerative cartilage lesions and osteoarthritis. Knee Surg Sports Traumatol Arthrosc 2011; 19(4): 528-535.

[17] Kon E, Buda R, Filardo G, et al. Platelet-rich plasma: intra-articular knee injections produced favorable results on degenerative cartilage lesions. Knee Surg Sports Traumatol Arthrosc 2010; 18(4): 472-479.

[18] Jang SJ, Kim JD, and Cha SS. Platelet-rich plasma (PRP) injections as an effective treatment for early osteoarthritis. Eur J Orthop Surg Traumatol 2013; 23(5): 573-580.

[19] Patel S, Dhillon MS, Aggarwal S, et al. Treatment with platelet-rich plasma is more effective than placebo for knee osteoarthritis: a prospective, double-blind, randomized trial. Am J Sports Med 2013; 41(2): 356-364.