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Platelet-Rich Plasma Therapy in Rheumatoid Arthritis Clinical Observation of Knee Joint Involvement with Osteoarthritis

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Abstract

Objective: To observe the clinical efficacy of intra-articular injection of platelet-rich plasma (PRP) in patients with rheumatoid arthritis (RA) and osteoarthritis (OA). **Method:** Sixty patients were divided into an experimental group and a control group. The experimental group was injected with betamethasone sodium phosphate 5.26 mg combined with PRP3 ml in the knee joint cavity for the first time, and then injected with PRP once a week for a total of 4 times. In the control group, a betamethasone sodium phosphate injection of 5.26 mg combined with a sodium hyaluronate injection of 2 ml was injected into the knee joint cavity for the first time, and then sodium hyaluronate injection was injected weekly for a total of 4 times. All patients were followed up for 3 months after treatment. The levels of serum inflammatory factors [C-reactive protein (CRP), erythrocyte sedimentation rate (ESR)] before and after treatment were compared between the two groups. The scores of the osteoarthritis index scale (WOMAC), visual analogue scale (VAS) and Lysholm knee score (LKS) were compared before and 1 and 3 months after treatment. **Results:** After treatment, the levels of serum CRP and ESR in the two groups were lower than those before treatment, and those in the experimental group were lower than those in the control group ($P < 0.05$). After 1 month and 3 months of treatment, the WOMAC and VAS scores of the two groups were lower than those before treatment, the LKS score was higher than that before treatment, and the WOMAC and VAS scores of the experimental group were lower than those of the control group, and the LKS score was higher than that of the control group ($P < 0.05$). **Conclusion:** Intra-articular injection of PRP is effective in the treatment of RA patients with knee osteoarthritis, which can significantly regulate the levels of inflammatory factors, improve knee joint function, and relieve pain.

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Keywords

Platelet-Rich Plasma, Intra-Articular Injection, Rheumatoid Arthritis, Osteoarthritis

1. Introduction

Rheumatoid arthritis (RA) and Osteoarthritis (OA) are common joint diseases, and their incidence is increasing year by year, which seriously affects the quality of life of patients. Especially in the case of knee involvement, patients often face joint pain, limited movement, and severe knee deformity. The current treatment is mainly based on oral drugs and local injection of glucocorticoids and sodium hyaluronate. However, because articular cartilage does not have a strong ability to regenerate and repair, the efficacy is poor and the treatment is difficult. Platelet-rich Plasma (PRP) is a kind of Platelet concentrate, which is obtained from autologous blood by centrifugation and contains a high concentration of platelets, white blood cells and fibrin. It is rich in growth factors and inflammatory regulators. It can repair damaged bones and joints, tendons, cartilage, etc., and has antibacterial, hemostatic and analgesic effects [1]. As a new treatment method, PRP has attracted more and more attention in the treatment of joint diseases, but it is rarely used in rheumatology and immunology. The aim of this study is to investigate the effect of platelet-rich plasma (PRP) in patients with rheumatoid arthritis (RA) and osteoarthritis (OA).

2. Literature and Methods

2.1. General Information

Patients with rheumatoid arthritis combined with osteoarthritis knee involvement in the Department of Rheumatology and Immunology, Jingzhou First People's Hospital from January 2024 to January 2025 were selected as the research objects. According to the random number table method, they were divided into the PRP intra-articular injection group (experimental group) and sodium hyaluronate intra-articular injection group (control group), with 30 cases in each group. The age of the experimental group was 48 - 70 (53.28 ± 1.32) years. The disease duration was 1.46 - 6.38 (3.64 ± 0.19) years. The age of the control group was 46 - 71 (53.47 ± 1.26) years. The disease duration was 1.35 - 6.55 (3.47 ± 0.16) years. There was no significant difference in baseline data between the two groups ($P > 0.05$). This study was reviewed and approved by the ethics committee of the hospital, and informed consent was signed by patients and their families.

Inclusion criteria: 1) RA was diagnosed according to the 2010 ACR rheumatoid arthritis classification criteria [2], 3.2 < DAS28 score ≤ 5.2, moderate disease activity. The diagnostic criteria of OA were revised by the Chinese Orthopaedic Society in 2007, and the imaging grades were in accordance with Kellgren-Lawrence grade II-III [3]. Exclusion criteria: 1) patients with tumor, hematologic disease, psychosis, serious cardiovascular disease, serious systemic or treatment site infec-

tion; 2) platelet count < 100 * 10^9/L; 3) those who had undergone arthroscopic surgery or hand-washing within six months; 4) patients with allergic constitution or allergy to multiple drugs.

2.2. Methods

1) PRP Preparation: A special centrifuge machine is used for PRP preparation and related kits (Lancotai Bio). The actual operation links are as follows: Blood samples (10 ml) were collected in the fasting state of the patient in the morning, centrifuged (1000 r/min, 20 min), and the lower layer of red blood cells were collected. The remaining blood samples were centrifuged again to ensure that the surface of the bottom red blood cells showed a tunical-like substance (*i.e.*, the deposition layer of platelets and white blood cells), and the upper plasma was collected. The plasma (about 3 ml) left in the centrifuge tube is PRP.

2) In the experimental group, betamethasone sodium phosphate 5.26 mg combined with PRP 3 ml was injected into the knee joint for the first time, and then PRP was injected once a week for a total of 4 times. In the control group, a betamethasone sodium phosphate injection 5.26 mg combined with sodium hyaluronate (20 mg:2 ml) injection 2 ml was injected into the knee joint cavity for the first time, and then sodium hyaluronate injection was injected weekly for a total of 4 times.

2.3. Indicators of Observation

1) The changes in serum erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) were detected before treatment, 1 month and 3 months after treatment.

2) The visual analogue scale (VAS) was used to evaluate the pain status of the two groups before treatment, 1 month and 3 months after treatment, with a score of 10. The higher the score, the more severe the pain.McMaster University Osteoarthritis Index (WOMAC) was used to evaluate the recovery of knee joint function in the two groups, including stiffness (2 items), joint function (17 items), pain (5 items) and other dimensions, each item scored 0 - 4 points. The lower the score, the better the functional status of the patients. The Lysholm knee score (LKS) was used to evaluate the knee joint function. The scoring system consisted of 8 items, such as pain, instability, atresia, swelling, lameness, stair climbing, squatting, and use of support. The score ranged from 0 to 100, and the higher the score, the better the knee function.

2.4. Statistical Methods

SPSS 25.0 statistical software was used for analysis. Measurement data obedient to normal distribution and homogeneity of variance were described by mean ± standard deviation. Independent sample t test was used for comparison between groups. The VAS score, WOMAC osteoarthritis index scale and Lysholm score were compared by repeated measurement data analysis of variance. All statistical tests were performed by two-sided test, and $P < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of Related Detection Indicators

Before treatment, there was no significant difference in serum CRP and ESR between the two groups ($P > 0.05$). After 1 month and 3 months of treatment, the serum CRP and ESR of the two groups were significantly lower than those before treatment, and the experimental group was lower than the control group ($P < 0.05$) (Table 1).

Table 1. CRP and ESR were compared between the two groups at different time points and before and after treatment ($\overline{x} \pm s$, score).

Group	ESR (mm/H)			CRP (mg/L)		
	Before treatment	1 month after treatment	3 months after treatment	Before treatment	1 month after treatment	3 months after treatment
Experimental group	67.21 ± 5.53	32.29 ± 4.18*	14.32 ± 2.13*	54.32 ± 4.23	16.12 ± 2.16*	5.23 ± 0.46*
Control group	67.02 ± 5.42	42.35 ± 4.87*	23.46 ± 2.56*	54.01 ± 4.10	24.23 ± 2.45*	14.43 ± 1.23
t	0.139	8.618	15.030	0.288	13.601	32.245
p	0.892	0.001	0.001	0.774	0.001	0.001
Group main effect	$F = 643.27$, $P < 0.001$			$F = 1024.56$, $P < 0.001$		
Time main effect	$F = 1852.64$, $P < 0.001$			$F = 2847.32$, $P < 0.001$		
Time * Group	$F = 428.59$, $P < 0.001$			$F = 512.78$, $P < 0.001$		

Note: Comparison between groups, *$P < 0.05$.

3.2. The VAS Scores of the Two Groups were Analyzed

Before treatment, there was no difference in VAS scores between the two groups ($P > 0.05$). The VAS scores of the two groups decreased significantly after 1 month and 3 months of treatment, and the scores of the experimental group were lower than those of the control group ($P < 0.05$) (Table 2).

Table 2. The VAS scores of the two groups at different time points and before and after treatment were compared points and before and after treatment ($\overline{x} \pm s$, score).

Group	n	Before treatment	1 month after treatment	3 months after treatment
Experimental group	30	7.21 ± 1.24	3.37 ± 0.52*	2.12 ± 0.27*
Control group	30	7.32 ± 1.32	4.96 ± 0.61*	3.65 ± 0.40*
t	-	0.334	10.839	17.461
p	-	0.728	0.001	0.001
Group main effect			$F = 97.14$, $P < 0.001$	
Time main effect			$F = 428.36$, $P < 0.001$	
Time * Group			$F = 12.67$, $P < 0.001$	

Note: Comparison between groups, *$P < 0.05$.

3.3. WOMAC Scores of the Two Groups Were Analyzed

Before treatment, there was no difference in WOMAC scores between the two groups ($P > 0.05$). The WOMAC scores of the two groups decreased significantly after 1 month and 3 months of treatment, and the scores of the experimental group were lower than those of the control group ($P < 0.05$) (Table 3).

Table 3. The WOMAC scores of the two groups at different time points and before and after treatment were compared points and before and after treatment ($\bar{x} \pm s$, score).

Group	n	Before treatment	1 month after treatment	3 months after treatment
Experimental group	30	58.13 ± 3.63	42.45 ± 3.12*	28.69 ± 2.42*
Control group	30	57.92 ± 3.43	49.65 ± 3.24*	39.15 ± 3.14*
t		0.240	9.121	15.369
p	-	0.812	0.001	0.001
Group main effect		$F = 156.32$, $P < 0.001$		
Time main effect		$F = 892.47$, $P < 0.001$		
Time * Group		$F = 38.56$, $P < 0.001$		

Note: Comparison between groups, *$P < 0.05$.

3.4. Lysholm Scores of the Two Groups Were Analyzed

Before treatment, there was no difference in Lysholm scores between the two groups ($P > 0.05$). The Lysholm scores of the two groups decreased significantly after 1 month and 3 months of treatment, and the scores of the experimental group were lower than those of the control group ($P < 0.05$) (Table 4).

Table 4. The Lysholm scores of the two groups at different time points and before and after treatment were compared points and before and after treatment ($\bar{x} \pm s$, score).

Group	n	Before treatment	1 month after treatment	3 months after treatment
Experimental group	30	40.86 ± 5.18	69.54 ± 7.31*	82.36 ± 6.21*
Control group	30	41.13 ± 5.36	61.38 ± 6.79*	73.28 ± 5.49*
t	-	0.216	4.720	6.152
p	-	0.836	0.001	0.001
Group main effect		$F = 87.45$, $P < 0.001$		
Time main effect		$F = 1243.76$, $P < 0.001$		
Time * Group		$F = 29.83$, $P < 0.001$		

Note: Comparison between groups, *$P < 0.05$.

4. Discussion

Rheumatoid arthritis (RA) is a chronic autoimmune disease characterized by progressive destruction of joints caused by aggressive synovial hyperplasia. Synovitis,

articular cartilage and bone destruction are important links in the pathogenesis of RA. Knee osteoarthritis mostly occurs in middle-aged and elderly people, and its pathological features are mainly non-bacterial synovitis, subchondral bone changes and articular cartilage degeneration, leading to loss of mobility and pain [4]. RA and OA are mutually affected and aggravated.PRP is a plasma containing a high concentration of platelets. In vivo and in vitro studies have found that α particles in PRP can release a variety of GF and cytokines. Many of these GF include vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), and vascular endothelial growth factor (VEGF), (PDGF) fibroblast growth factor 2 (FGF-2), transforming growth factor beta (Tgf-β), TGF-β and insulin like growth factor (IGF) contribute to human bone tissue regeneration and cartilage repair, accelerate the healing process, and restore joint function [5]-[8]. In 2008, it was first reported that intra-articular infusion of PRP in the treatment of osteoarthritis could significantly relieve pain and improve joint function [9]. Ruixue Liu *et al.* found that PRP could not only effectively improve the clinical symptoms of RA patients such as morning stiffness and joint swelling and pain, but also reduce biochemical indicators such as RF, ESR, and C-reactive protein [10].

CRP is an acute phase reaction protein in the development of inflammation. When its content in serum increases, it indicates obvious disease activity. ESR is a kind of non-specific acute phase reaction protein, which can reflect the aggregation ability of red blood cells. When the patient's condition progresses, ESR content increases abnormally [11]. The results of this study showed that the ESR and CRP of patients after PRP treatment were lower than those before treatment, and the decrease of PRP injection group was more obvious than that of the sodium hyaluronate injection group, which further supported that PRP can reduce inflammatory reaction.

Related studies in vivo have found that PRP treatment of CIA mice can down-regulate the expression of IL-6, IL-8, IL-17A, IL-1β, TNF-α, RANKL and IFN-γ, thereby inhibiting humoral and cellular immunity. Researchers believe that PRP can provide beneficial effects in reducing cartilage destruction and bone damage and repairing joint tissue. PRP can inhibit inflammation by synovial fibroblasts and regulate the PI3K/AKT signaling pathway, which provides a basic theoretical basis for the application of PRP in the treatment of RA [12]. Humeria *et al.* found that PRP treatment could relieve pain, inflammation and reduce VAS scores in RA patients who were insensitive or ineffective to drug therapy [13].

The results of this study showed that after PRP treatment, the VAS score and WOMAC score of the patients were significantly decreased, and the Lysholm score was increased. After 3 months of follow-up, it was found that the clinical efficacy had no obvious downward trend with the extension of time. Combined with other studies, the duration of efficacy of a single course of intra-articular injection of PRP can range from 3 months to 12 months [14] [15]. PRP can further improve the metabolic activity of cells, reduce the apoptosis rate, and produce a

gelatinous structure similar to the fibrous scaffold structure, which can relieve pain and improve joint function for a longer time, reconstruct joint function and surface, repair articular cartilage, and control the progression of lesions [16] [17]. Kon *et al.* showed that intra-articular injection of PRP was more effective than sodium hyaluronate, and prospective studies of domestic scholars also suggested that its long-term clinical efficacy was better than sodium hyaluronate [18]. Zhou Meng's study showed that after PRP treatment, the VAS score and WOMAC score of patients were significantly improved compared with those before treatment, suggesting that intra-articular injection of PRP is effective in the treatment of ERA combined with OA [19]. Our study showed that intra-articular injection of PRP was more effective than sodium hyaluronate, and it was still effective after 3 months of treatment, so intra-articular injection of PRP was better than sodium hyaluronate. At present, there are relatively few studies on PRP in RA patients with OA, and there is a lack of long-term efficacy evaluation and control studies. We are in the process of a 12-month extension study, and more relevant studies are needed for further verification.

In conclusion, intra-articular injection of PRP in the treatment of knee osteoarthritis in RA patients with OA has a certain effect, which can effectively relieve joint pain symptoms, promote the recovery of knee joint function, and have good safety. However, the sample size of this study is small and has certain limitations. In order to further explore the efficacy of PRP, clinical research samples need to be enlarged.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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