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Research Article

Comparison of the Efficiency of Platelet-Rich Plasma and Corticosteroid Injection Therapies in Improving Pain and Shoulder Functions in Subacromial Impingement Syndrome

Izzet Bingol,[1] Vedat Bicici[2]

[1]Department of Orthopaedics and Traumatology, 29 Mayıs State Hospital, Ankara, Turkey
[2]Department of Orthopaedics and Traumatology, Ankara City Hospital, Ankara, Turkey

Abstract

Objectives: Conservative treatment is the primary treatment modality for subacromial impingement syndrome (SIS), which includes rest, lifestyle changes, injections, strengthening the muscles around the scapula, ultrasound, and physical therapy modalities. While most patients who have received corticosteroid injections have reported recurrent symptoms, it was observed that there were no long-term effects and many complications were reported. Platelet-rich plasma (PRP) has recently attracted attention due to its many growth factors and proteins. In the current study, it was aimed to evaluate and compare the pain and functional effects of PRP and corticosteroid injections, which are among the SIS conservative treatment methods.

Methods: Of 114 patients who were conservatively treated via the subacromial injection method, 83 patients who met the study criteria were included. Demographic data of the patients, such as age, gender, and the affected part, were collected. The PRP and corticosteroid injection method applied to the subacromial space were recorded. The Visual Analog Scale (VAS) and Constant-Murley Score (CMS) were used to evaluate the pain and functional effects at the time of admission (pre-injection), and at 1, 3, and 6 months post-injection.

Results: The VAS value of the PRP group at 1 month post-injection was higher than that in the corticosteroid group, while the 6-month post-injection value was lower. Althought he CMS values of the PRP group at 3 and 6 months post-injection were higher than those in the corticosteroid group, the 1-month post-injection value was lower than that in the corticosteroid group.

Conclusion: It can be said that the pain of the patients was reduced and their joint functions were increased as a result of the PRP and corticosteroid injection treatments. Although corticosteroid was more effective than the PRP in the short term, it was observed that PRP was more effective in the long term.

Keywords: Corticosteroid, platelet-rich plasma, subacromial impingement syndrome, subacromial injection

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Subacromial impingement syndrome (SIS) is one of the most common causes of approximately half of shoulder pain.[1] The pain, which occurs with the irritation of the subacromial space and increases with the overhead movement of the arm and lifting the weight away from the body, spreads to the deltoid attachment area.[2] There is also bicep, pain that radiates to the anterior region of the arm and is particularly uncomfortable at night.

Address for correspondence: Izzet Bingol, MD. 29 Mayıs Devlet Hastanesi, Ortopedi ve Travmatoloji Kliniği, Ankara, Turkey
Phone: +90 532 554 99 38 **E-mail:** dr.izzetbingol@hotmail.com

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It has been suggested that many factors play a role in the etiology and mechanism of occurrence. It has been demonstrated that the anatomical shape of the acromion is important in SIS.[3] SIS is categorized as type 1 (straight), type 2 (curved), and type 3 (hooked), which have been anatomically described. It has been shown that types 2 and 3 are closely related with SIS, and especially type 3 is related with rotator cuff tears.[4,5] While there has been uncertainty between conservative and surgical treatment methods in the literature, the primary treatment method is conservative.[6]

Conservative treatment of SIS includes rest, lifestyle changes, injections, strengthening the muscles around the scapula, ultrasound, and physical therapy modalities.[7] Corticosteroid injections have been frequently used in SIS, and half of the patients reported recurrent symptoms; however, it was observed that they had no long-term effects.[8] In addition, it has many negative effects on the skin, such as atrophy, systemic absorption, infection, and tendon rupture.[9] Platelet-rich plasma (PRP) has recently begun to attract attention because it contains many growth factors and proteins that can be effective in tissue healing and bone regeneration.[10] In the literature, efficacy and comparison studies on PRP and corticosteroid injections have been published recently.

The aim of the current study was to evaluate and compare the pain and functional effects of PRP and corticosteroid injections, which are among the SIS conservative treatment methods.

Methods

Study Design and Participants

Between July 2018 and June 2020, the records of patients who received injections into the subacromial space due to SIS in a single center by the same physician were retrospectively examined. It was determined that 114 patients were treated conservatively via the subacromial injection method.

Patients included in the study were those who had been diagnosed with type 2 acromion SIS due to shoulder pain symptoms at least 3 months previously, were administered PRP or corticosteroid injections in conservative treatment, and attended their follow-ups regularly. Patients excluded from the study were those who had trauma, bone pathologies, rotator cuff weakness or tears, scapulohumeral arrhythmia, postural disorders, cervical radiculopathy, thoracic outlet syndrome, dermatological diseases involving the shoulder joint, neuromuscular diseases with muscle weakness, inflammatory joint disease, active tumor or hematological malignancy, infection, pregnancy, presence of other pathologies that may cause pain in the shoulder joint, previous injection in the shoulder area or shoulder and circumference operations, history of anticoagulant use, hemoglobin level <11 g/dL, or platelet count <150,000 mm^3. Hence, 83 patients who meet the inclusion criteria were included in the study.

The study protocol was approved by the Ethics Committee of Ankara City Hospital (reference number: E1-21-1557).

Demographic data of the patients, such as age, gender, and the affected party, were collected. The PRP and corticosteroid injection method applied to the subacromial space were recorded. The Visual Analog Scale (VAS)[11] and Constant-Murley Score (CMS)[12] were used to evaluate the pain and functional effects at the time of admission (pre-injection), and at 1, 3, and 6 months post-injection.

Diagnosis

A detailed history was taken from all of the patients, physical examinations were performed, and imaging methods were requested. Pain complaints that emerged with subacromial space irritation, spread to the deltoid attachment area, as well as to the biceps and the anterior region of the arm, disturbed the patient at night, and increased with overhead movement and weight lifting were recorded. The range of motion of the shoulder joint was evaluated. The Neer and Hawkins tests were conducted. After a detailed history and physical examination, routine blood tests including the complete blood count, C-reactive protein, and erythrocyte sedimentation rate were studied. Anterior-posterior shoulder (Grashey radiography), supraspinatus hatch, axillary radiographs, and magnetic resonance imaging were performed. A diagnosis and differential diagnosis of SIS was made as a result of anamnesis, physical examination, blood tests, and imaging methods.

Injection Application

A total of 14 mL of cubital blood was taken from the patient for the PRP application. Next, 2 mL of citrate was added to prevent coagulation. After placing it in a specially designed tube, a total of 16 mL of anticoagulated blood was centrifuged at 4000 rpm for 8 min, and concentrated buffy coat was drawn into the injector to obtain 3 mL of PRP. All of the materials used were sterile and disposable. For the corticosteroid application, a mixture of 1 mL betamethasone dipropionate and 2 mL of 2% lidocaine was prepared. Both types of injections were applied to the patients with a dorsolateral approach through the gap just below the dorsal acromial rim. The patient was followed-up in the supine position for 20 min following the injection.

Post-Injection Follow-up

Patients who received the injection were allowed to use paracetamol and apply cold when necessary. Nonsteroidal antiinflammatory drugs were not used due to the risk of reducing the effect of the PRP. The patients performed rotator cuff stretching and a strengthening exercise program for 6 weeks.

Study Measurements

All of the evaluations were made by the same researcher.

Visual Analog Scale

The VAS is used to convert some values that cannot be measured numerically into numerical ones.[11] Two end definitions of the parameter to be evaluated are written on both ends of a 100-mm line and the patient is asked to indicate where his condition is appropriate by drawing a line or by placing a point or pointing on this line. The length of the distance from the place where there is no pain to the point marked by the patient indicates the pain of the patient.

Constant-Murley Score

The CMS is a scoring system that provides a comprehensive and comparable evaluation of shoulder functions.[12] It includes 4 sub-ratings: pain (15 points), activities of daily living (20 points), strength (25 points), and range of motion: forward elevation, external rotation, abduction, and internal rotation of the shoulder (40 points). A high score indicates higher function quality.

Statistical Analysis

Data analyses were performed using IBM SPSS for Windows, 22.0 (IBM Corp., Armonk, NY, USA). Whether the distribution of the continuous variables was normal or not was determined using the Kolmogorov-Smirnov test. The Levene test was used for evaluation of the homogeneity of the variances. Unless specified otherwise, the continuous data were described as the mean±SD for normal distributions, the mean±SD and median (interquartile range) for skewed distributions. Categorical data were described as the number of cases (%). Statistical analysis differences in the non-normally distributed variables between two independent groups were compared using the Mann-Whitney U test, while the differences in the non-normally distributed variables among more than two dependent groups were analyzed using the Friedman test. P<0.05 was accepted as significant level for all of the statistical analyses.

Results

There were no statistically significant differences between the PRP and corticosteroid groups in the examination of demographic data, such as the gender, side of the procedure, or age (p>0.05; Table 1).

There was no statistically significant difference in the VAS scores between the groups pre-injection or at 3 months post-injection (p>0.05). The 1-month post-injection VAS score of the PRP group was statistically significantly higher than that in the corticosteroid group, and the 6-month post-injection score was lower (p<0.001; Fig. 1).

There was no statistically significant difference in the pre-injection CMS values between the groups (p>0.05). The 3- and 6-month post-injection CMS values of the PRP group were statistically significantly higher than those in the corticosteroid group, and the 1-month post-injection value was lower (p<0.001) (Fig. 2).

Table 1. Demographic data

	Group		Group comparison
	PRP (n=37)	Corticosteroid (n=46)	p
Gender			
M	14 (37.8)	18 (39.1)	0.904
F	23 (62.2)	28 (60.9)	
Side			
L	15 (40.5)	19 (41.3)	0.944
R	22 (59.5)	27 (58.7)	
Age	49.03±7.09	49.93±6.91	0.558

Categorical variables are expressed as the frequency and percentage and categorical variables were compared using the Pearson chi-square test or Fisher exact test. Normally distributed continuous variables are expressed as the mean±standard deviation (SD) and continuous variables were compared using the student t test. Statistically significant P-values are in bold.

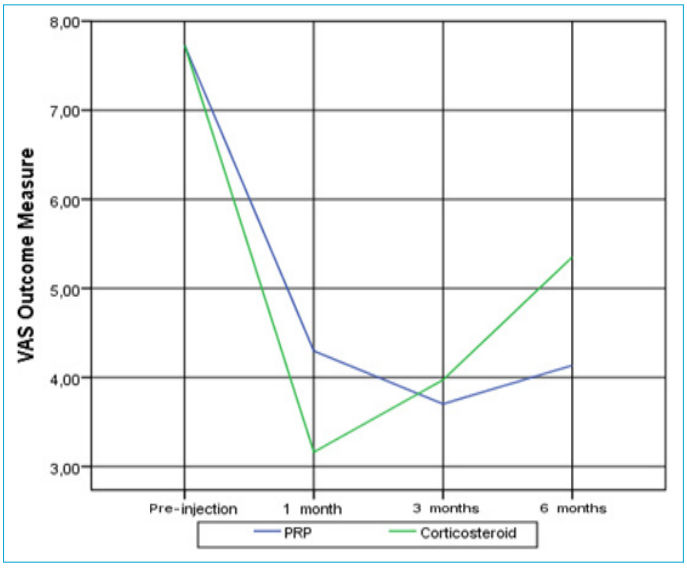

Figure 1. VAS outcome measure.

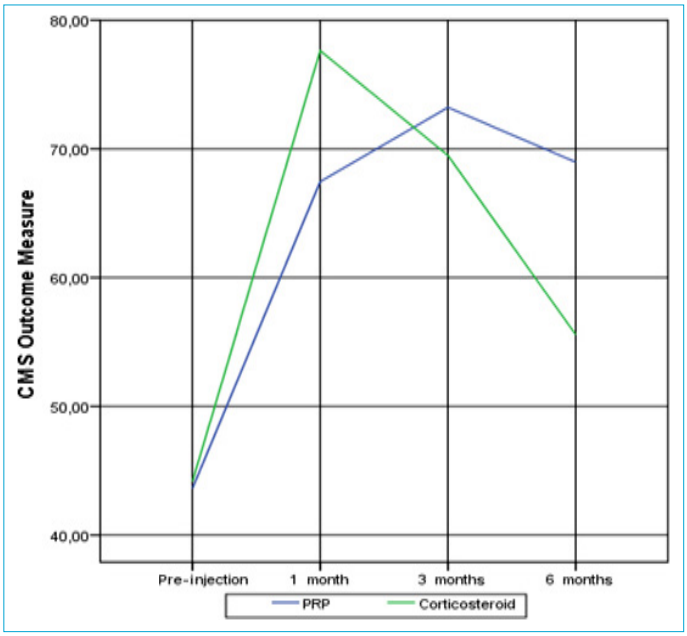

Figure 2. CMS outcome measure.

There was a statistically significant difference between both the VAS and CMS scores in the PRP and corticosteroid groups (Table 2).

PRP group: There were no statistically significant differences between the 1- and 6-month post-injection and 3- and 6-month post-injection VAS scores (p>0.05). There was a statistically significant decrease at 1, 3, and 6 months post-injection when compared to pre-injection (p<0.001). The 3-month post-injection score also decreased significantly when compared to the 1-month post-injection score (p<0.001).

There was no statistically significant difference between the 1- and 6-month CMS values (p>0.05). There was a statistically significant increase at 1, 3, and 6 months post-injection when compared to pre-injection (p<0.001). The 3-month post-injection value showed a significant increase when compared to the 1-month post-injection value (p<0.001). In addition, the 6-month post-injection value also decreased significantly when compared to the 3-month post-injection value (p<0.001).

Corticosteroid group: There was no statistically significant difference between the 1- and 3-month post-injection VAS scores (p>0.05). There was a statistically significant decrease at 1, 3, and 6 months post-injection when compared to pre-injection (p<0.001). The 6-month post-injection value showed a significant increase when compared to both 1 and 3 months post-injection (p<0.001).

There was a statistically significant increase in the CMS value at 1, 3, and 6 months post-injection when compared to pre-injection (p<0.001). A statistically significant decrease was observed from 1-month post-injection to 6-months post-injection (p<0.001). That is, there was a significant difference between all of the groups.

Discussion

The most striking result of this study was the determination that while the corticosteroids were more effective in

Table 2. Comparison of the VAS and CMS scores of the groups

	Group				Group comparison
	PRP (n=37)		Corticosteroid (n=46)		p
Pre-injection VAS	7.73±1.30	8 (2)	7.74±1.14	8 (2)	0.974
1-month post-injection VAS	4.30±0.85	4 (1)	3.15±0.94	3 (1)	<0.001
3-month post-injection VAS	3.70±0.66	4 (1)	3.91±0.86	4 (1)	0.322
6-month post-injection VAS	4.14±0.67	4 (1)	5.30±0.89	5 (1)	<0.001
Repeated measures comparisons (P-value)	<0.001[a, b, c, d]		<0.001[a, b, c, d, g]		
Pre-injection CMS	43.62±2.53	43 (3)	44.26±2.17	45 (2)	0.082
1-month post-injection CMS	67.46±4.05	67 (5)	78.09±3.93	78 (3)	<0.001
3-month post-injection CMS	73.22±4.88	73 (7)	70.00±4.08	70 (3)	0.005
6-monthpost-injection CMS	68.97±4.78	69 (6.5)	56.07±3.71	56.5 (4)	<0.001
Repeated measures comparisons (P-value)	<0.001[a, b, c, e, g]		<0.001[a, b, c, d, e, g]		

Non-normally distributed continuous variables are expressed as the mean±standard deviation (SD) and median (interquartile range). Statistical analysis differences in the non-normally distributed variables between 2 independent groups were compared using the Mann-Whitney U test. Statistical analysis differences in the non-normally distributed variables between 4 dependent groups were compared using the Friedman test. Significant differences were found between the following: a) pre-injectionvs.1month post-injection, b) pre-injection vs. 3 months post-injection, c) pre-injection vs. 6 months post-injection, d) 1 month vs. 3 months post-injection, e) 1 month vs. 6 months post-injection, and g) 3 months vs. 6 months post-injection.Statistically significant P-values are in bold.

the short term after subacromial injection with the diagnosis of SIS, PRP was more effective in the long term.

Since PRP contains a concentrated platelet solution prepared with autologous blood, its clinical use has been found to be safe.[13] While it increases the modulation of bioactive factors in the damaged area, collagen production, and the tenocyte replication of many growth factors, it also increases tissue regeneration potential by stimulating the synthesis of the ligament matrix.[14,15] Subacromial corticosteroid injection is considered an inexpensive and effective treatment option; however, its side effects have raised concerns in clinical practice. Complications such as tendinous ruptures, nerve and muscle atrophy, hypopigmentation of the skin, dystrophic calcification around the joint capsule, and hyperglycemia and inhibition of the pituitary hypothalamic axis may occur after a certain period of time following corticosteroid administration.[16]

Say et al.[17] stated that steroid injection in SIS treatment was more effective than PRP injection in terms of the CMS and VAS for pain at 6 weeks and 6 months. Pasin et al.[18] reported that PRP injection showed higher scores in the eighth week when compared to corticosteroid injection and physical therapy in the comparison of pain and function scores in 3 groups of patients who were treated conservatively with physical therapy, PRP and corticosteroid injection for SIS, and thus, PRP injection in the long term. They stated that it was more effective than corticosteroid injection and physical therapy. Barreto et al.[19] concluded that PRP and corticosteroid subacromial injections had a positive and similar clinical response in the treatment of rotator cuff tendinopathies. In their scores regarding joint motion and strength, they found significant results only at 1 and 3 months post-injection, and functional deterioration was observed in the corticosteroid group at 6 months post-injection. As a result, they stated that PRP was a safer treatment method when compared to corticosteroid injection. Studies have shown that there is no consensus on the results of PRP and corticosteroid injections in SIS treatment. In the current study, while the 1-month post-injection VAS value of the PRP group was higher than in the corticosteroid group, the 6-month post-injection VAS score was lower. While the CMS values of the PRP group at 3 and 6 months post-injection were higher than in the corticosteroid group, the 1-month post-injection CMS values were lower than in the corticosteroid group.

The lack of randomized and placebo groups, sufficient follow-up periods, and radiological and histopathological results were the limitations of the study. Its strength was that it minimized the effect of other pathologies by including patients with isolated type 2 acromion SIS in the study.

With the diagnosis of SIS, it can be said that PRP and corticosteroid injection treatments, which are among the conservative treatment methods, decrease pain and increase joint function. Although corticosteroids are more effective than PRP in the short term, it was observed that PRP was more effective in the long term. Long-term follow-up, tissue imaging, or histopathological studies are required to compare the long-term effects of PRP and corticosteroids. Considering the unwanted side effects of corticosteroids and the positive effects of PRP as a result of the literature and the study herein, it is our belief that PRP may be preferred over corticosteroid injection in SIS treatment.

Disclosures

Ethics Committee Approval: The study protocol was approved by the Ethics Committee of Ankara City Hospital (reference number: E1-21-1557).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – İ.B.; Design – İ.B.; Supervision – İ.B.; Materials –İ.B.; Data collection &/or processing – İ.B.; Analysis and/or interpretation – İ.B., V.B.; Literature search –İ.B., V.B.; Writing – İ.B.; Critical review –İ.B., V.B.

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