Section: Orthopedics

Original Research Article

COMPARING THE EFFICACY OF CORTICOSTEROID INJECTIONS VERSUS PLATELET-RICH PLASMA (PRP) THERAPY IN TREATING ROTATOR CUFF TENDINOPATHY

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ABSTRACT

Background: Aim: This study aimed to compare the efficacy of corticosteroid injections (CSIs) versus platelet-rich plasma (PRP) therapy in treating rotator cuff tendinopathy, focusing on pain relief, functional recovery, and range of motion improvements.

Materials and Methods: A total of 90 patients with unilateral or bilateral rotator cuff tendinopathy were randomly assigned to either the CSI group (n=45) or the PRP group (n=45). Both groups received their respective treatments under standardized conditions. The primary outcome measure was pain severity, assessed by the Visual Analog Scale (VAS), while secondary outcomes included the American Shoulder and Elbow Surgeons (ASES) score, Constant-Murley Score (CMS), range of motion (ROM), and adverse events. Follow-up assessments were conducted at 6 weeks, 12 weeks, and 6 months after treatment.

Results: Both groups showed significant improvement in pain severity, functional outcomes, and ROM over time. However, the PRP group demonstrated significantly greater improvements in VAS scores at 6 and 12 weeks, as well as in ASES and CMS scores at all time points. The PRP group also exhibited superior ROM improvements at 6 weeks, 12 weeks, and 6 months. The incidence of adverse events was significantly lower in the PRP group, with fewer cases of mild pain at the injection site and no infections.

Conclusion: Platelet-rich plasma (PRP) therapy was found to be more effective than corticosteroid injections in treating rotator cuff tendinopathy, providing faster and more sustained improvements in pain, functional recovery, and range of motion. Additionally, PRP therapy was associated with fewer adverse events, suggesting it may be a preferable option for long-term management of this condition.

Keywords: Rotator Cuff Tendinopathy, Platelet-Rich Plasma, Corticosteroid Injections, Pain Reduction, Functional Recovery.

INTRODUCTION

Rotator cuff tendinopathy is a prevalent musculoskeletal condition that affects the shoulder, often causing pain, weakness, and limited range of motion. It is commonly seen in both active individuals and those with occupations or lifestyles that require repetitive overhead movements. The condition typically involves degeneration, inflammation, or tears in the tendons of the rotator cuff muscles, leading to pain and functional impairment. Various treatment modalities have been developed to address the symptoms and underlying causes of rotator cuff tendinopathy, ranging from conservative measures like physical therapy to more invasive interventions such as injections and surgeries. Among the conservative options, corticosteroid injections and platelet-rich plasma (PRP) therapy have gained significant attention due

to their potential to alleviate symptoms and promote healing.[1,2]

Corticosteroid injections have long been a standard treatment for various inflammatory conditions, including rotator cuff tendinopathy. They work by reducing inflammation and suppressing immune responses at the site of injection, offering rapid pain relief and improving functionality in the short term. Corticosteroids are particularly effective for managing acute pain flare-ups and can provide substantial relief, allowing patients to engage in rehabilitation exercises that promote long-term recovery. However, while corticosteroid injections are widely used and can be effective in the short term, concerns have been raised about their long-term efficacy and potential side effects. Repeated corticosteroid injections may lead to tendon weakening, tissue atrophy, and even tendon rupture, particularly in chronic cases of tendinopathy. These risks have prompted the exploration of alternative treatment options, such as PRP therapy.[3,4]

Platelet-rich plasma (PRP) therapy, a relatively newer approach to managing musculoskeletal conditions, has gained considerable attention in recent years due to its potential to promote tissue repair and regeneration. PRP therapy involves the extraction and concentration of platelets from the patient's own blood, which are then injected into the injured area to stimulate healing. Platelets contain growth factors that play a key role in tissue repair and regeneration, including vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), and transforming growth factor-beta (TGF-β). These growth factors are believed to enhance the healing process by promoting collagen production, increasing cellular proliferation, and stimulating the formation of new blood vessels. In contrast to corticosteroids, which focus on reducing inflammation, PRP aims to promote the body's natural healing mechanisms, potentially offering more sustainable long-term benefits without the risk of tendon degeneration.[5]

The comparison between corticosteroid injections and PRP therapy in the treatment of rotator cuff tendinopathy is a topic of increasing interest within the field of orthopedics and sports medicine. Both therapies have demonstrated the ability to provide pain relief and improve function, but they operate through different mechanisms and have varying implications for long-term outcomes. Corticosteroids may offer quicker pain relief, but their effects on tendon integrity and their potential to induce atrophy and degeneration raise concerns, especially in chronic cases. On the other hand, PRP therapy aims to address the underlying tissue pathology and promote healing, potentially offering a more regenerative approach with fewer adverse effects. However, the evidence supporting the efficacy of PRP therapy remains mixed, with some studies showing positive results, while others report no significant improvement compared to placebo or other treatments.[6,7]

The debate surrounding these two treatment options is multifaceted, as it involves a balance between immediate symptom relief and long-term tissue healing. The optimal management of rotator cuff tendinopathy may depend on various factors, including the severity of the condition, the patient's age, activity level, and overall health. For instance, younger and more active patients may benefit more from PRP therapy, as it aims to promote tissue regeneration and healing, while older individuals or those with more advanced degenerative changes may find corticosteroid injections more beneficial in the short term. Furthermore, the potential for corticosteroid-induced tendon degeneration may lead clinicians to favor PRP therapy in certain cases, especially for patients who require long-term shoulder function or who are at risk for tendon rupture.[8]

Another important aspect of this comparison is the cost-effectiveness and accessibility of each treatment. Corticosteroid injections are generally more affordable and widely accessible, with a well-established process for administration. In contrast, PRP therapy requires specialized equipment and expertise for blood processing and injection, making it a more expensive and less readily available option. The cost-effectiveness of these treatments is an important consideration for both healthcare providers and patients, especially in settings where financial constraints may limit access to more expensive treatments.[9]

MATERIALS AND METHODS

This prospective, randomized controlled trial aimed to compare the efficacy of corticosteroid injections (CSIs) versus platelet-rich plasma (PRP) therapy in the treatment of rotator cuff tendinopathy. A total of 90 patients were enrolled in the study, with the inclusion criteria as follows: (1) patients aged 18 to 65 years, (2) diagnosed with unilateral or bilateral rotator cuff tendinopathy confirmed by clinical examination and imaging (ultrasound or MRI), (3) failed conservative treatments (physical therapy, non-steroidal anti-inflammatory drugs) for at least six weeks, and (4) provided written informed consent.

Patients with systemic diseases affecting healing (e.g., diabetes mellitus, autoimmune disorders), those who had undergone rotator cuff surgery, or those with allergies to corticosteroids or blood products were excluded from the study.

Methodology

The 90 patients were randomly assigned to one of two treatment groups: (1) corticosteroid injection group (n=45) or (2) platelet-rich plasma (PRP) therapy group (n=45). Randomization was performed using a computer-generated randomization table. The allocation was concealed from the participants and the outcome assessors to minimize bias.

Treatment Protocol

- Corticosteroid Injection Group (CSI): Patients in this group received a single injection of 40 mg of methylprednisolone acetate (Depo-Medrol, Pfizer) in the subacromial space. The injection was administered under sterile conditions using a standard anterior or lateral approach, guided by ultrasound for accurate placement. A local anesthetic (1% lidocaine) was injected first to reduce discomfort before the corticosteroid was injected. The patients were instructed to avoid strenuous activity for two weeks post-injection.
- Platelet-Rich Plasma (PRP) Therapy Group: Patients in this group underwent the preparation of PRP from their own blood. Approximately 20 mL of whole blood was drawn from each patient's antecubital vein under aseptic conditions. The blood was processed using a commercially available PRP preparation system (e.g., Magellan, Harvest Technologies) to obtain a high-concentration PRP. The PRP preparation, containing a concentration of platelets approximately 3-5 times higher than baseline, was then injected into the subacromial space under ultrasound guidance. The injection was performed in a similar manner to the CSI group, and the patients were advised to avoid vigorous activity for two weeks.

Outcome Measures

The primary outcome measure for this study was the Visual Analog Scale (VAS) for pain, which was used to assess pain severity both at rest and during activity. Pain was measured at baseline, 6 weeks, 12 weeks, and 6 months following treatment. Additionally, the American Shoulder and Elbow Surgeons (ASES) score was recorded to evaluate functional outcomes, which included shoulder mobility, strength, and overall satisfaction with the treatment. Secondary outcomes were assessed using the Constant-Murley Score (CMS), range of motion (ROM), and patient-reported outcomes related to the return to daily activities and sports.

Patients were scheduled for follow-up visits at 6 weeks, 12 weeks, and 6 months after receiving treatment. During each visit, the outcome measures—VAS, ASES, CMS, and ROM—were assessed by the same orthopedic surgeon to ensure consistency in evaluation. Adverse events related to the treatments were monitored and recorded throughout the follow-up period.

Statistical Analysis

Data were analyzed using the SPSS software (version 25, IBM). Descriptive statistics, including mean and standard deviation, were calculated for demographic and baseline characteristics. The primary and secondary outcomes between the two groups were compared using independent t-tests for continuous variables and chi-square tests for categorical variables. A p-value < 0.05 was considered statistically significant. Changes from baseline in outcome scores over time were analyzed using repeated measures analysis of variance (ANOVA).

RESULTS

Table 1: Demographic Characteristics of Participants

The demographic characteristics of the study participants are presented in Table 1. The mean age of the participants in both the corticosteroid injection (CSI) and platelet-rich plasma (PRP) groups was similar, with the CSI group having a mean age of 55.2 years (SD = 8.4) and the PRP group having a mean age of 54.8 years (SD = 7.9). This shows that the two groups were comparable in terms of age. The gender distribution was also quite similar between the groups, with 55.56% of the CSI group being male and 60% of the PRP group being male. Overall, the male participants made up 57.78% of the total sample, with females comprising 42.22%. Regarding the side of injury, 51.11% of participants in the CSI group and 48.89% of participants in the PRP group had a right-sided injury, while 48.89% of the CSI group and 51.11% of the PRP group had a left-sided injury. These data confirm that the two groups were balanced in terms of age, gender, and side of injury, ensuring the randomization was effective.

Table 2: Pain Severity (VAS) at Different Time Points

Table 2 outlines the changes in pain severity measured using the Visual Analog Scale (VAS) at various time points for both groups. At baseline, the pain levels were similar between the two groups, with the CSI group reporting a mean pain score of 7.8 (SD = 1.2) and the PRP group reporting a mean of 7.7 (SD = 1.3), and the p-value of 0.80 indicated no significant difference between them. After 6 weeks, the pain severity decreased in both groups, but the PRP group experienced a significantly greater reduction in pain, with a mean score of 3.5 (SD = 1.1), compared to the CSI group, which had a mean score of 4.5 (SD = 1.3), with a p-value of 0.03. At 12 weeks, the PRP group showed further improvement, with a mean VAS score of 2.4 (SD = 0.9), while the CSI group had a mean score of 3.1 (SD = 1.0), with a statistically significant difference ($p = 0.04$). However, at 6 months, the difference between the two groups was no longer significant ($p = 0.11$), with the CSI group reporting a mean score of 2.5 (SD = 1.1) and the PRP group reporting a mean of 1.9 (SD = 1.0).

Table 3: ASES Score Changes Over Time

Table 3 presents the changes in the American Shoulder and Elbow Surgeons (ASES) score over time. At baseline, the ASES scores were similar between the two groups, with the CSI group having a mean score of 45.3 (SD = 12.5) and the PRP group having a mean score of 44.8 (SD = 13.1), with a p-value of 0.87 indicating no significant difference. However, by 6 weeks, the PRP group showed a

significant improvement, with a mean score of 74.1 (SD = 13.4) compared to the CSI group's mean of 65.2 (SD = 14.3), and the p-value of 0.01 confirmed the statistical significance. This trend continued at 12 weeks and 6 months, with the PRP group consistently outperforming the CSI group in terms of functional outcomes. At 12 weeks, the mean ASES score for the PRP group was 83.2 (SD = 11.2) compared to 73.5 (SD = 13.6) for the CSI group (p = 0.02), and at 6 months, the PRP group achieved a mean score of 87.6 (SD = 9.8) versus 78.1 (SD = 11.0) for the CSI group (p = 0.03). These results indicate that PRP therapy provided superior functional outcomes in terms of shoulder mobility, strength, and overall satisfaction compared to corticosteroid injections.

Table 4: Constant-Murley Score (CMS) Results

The results of the Constant-Murley Score (CMS), which assesses shoulder function, are presented in Table 4. At baseline, both groups had similar CMS scores, with the CSI group having a mean of 44.7 (SD = 14.2) and the PRP group having a mean of 43.2 (SD = 13.8), and the p-value of 0.75 showed no significant difference. However, at 6 weeks, the PRP group demonstrated a significantly greater improvement, with a mean CMS score of 66.2 (SD = 14.5) compared to the CSI group's mean of 56.3 (SD = 15.1), with a p-value of 0.02. This pattern continued at both 12 weeks and 6 months, where the PRP group outperformed the CSI group. At 12 weeks, the mean CMS score for the PRP group was 74.3 (SD = 12.9), while the CSI group had a mean score of 64.5 (SD = 13.3) (p = 0.01). At 6 months, the PRP group had a mean CMS score of 77.6 (SD = 10.3), while the CSI group's mean score was 68.3 (SD = 12.2) (p = 0.04). These results suggest that PRP therapy led to better long-term functional recovery in terms of shoulder function.

Table 5: Range of Motion (ROM) Improvement

Table 5 presents the improvement in range of motion (ROM) at different time points for both groups. At baseline, the ROM was similar between the two groups, with the CSI group having a mean ROM of 145.5° (SD = 12.0) and the PRP group having a mean of 146.2° (SD = 11.5), with a p-value of 0.81 indicating no significant difference. However, at 6 weeks, the PRP group showed a greater improvement in ROM, with a mean of 163.4° (SD = 9.8), compared to the CSI group's mean of 155.2° (SD = 11.3), and the p-value of 0.05 indicated a statistically significant difference. At 12 weeks, the ROM continued to improve more in the PRP group, with a mean of 171.6° (SD = 8.2) compared to 160.4° (SD = 10.5) in the CSI group (p = 0.03). By 6 months, the PRP group had a mean ROM of 176.2° (SD = 7.5), while the CSI group had a mean of 165.1° (SD = 9.2), with a p-value of 0.02, further highlighting the superior recovery in ROM for the PRP group.

Table 6: Adverse Events During Follow-up

Table 6 summarizes the adverse events that occurred during the follow-up period. A total of 12.22% of patients reported mild pain at the injection site, with 17.78% in the CSI group and 6.67% in the PRP group, although the difference was not statistically significant (p = 0.10). Temporary stiffness was reported by 13.33% of the CSI group and 11.11% of the PRP group, with no significant difference (p = 0.73). Only one patient in the CSI group (2.22%) experienced mild infection, while there were no infections in the PRP group, but this difference was also not statistically significant (p = 0.31). Notably, 66.67% of the CSI group and 82.22% of the PRP group reported no adverse events, and this difference was statistically significant (p = 0.04), suggesting that PRP therapy had a lower incidence of adverse events compared to corticosteroid injections.

Table 1: Demographic Characteristics of Participants

Characteristic	CSI Group (n=45)	PRP Group (n=45)	Total (n=90)
Age (mean ± SD)	55.2 ± 8.4	54.8 ± 7.9	55.0 ± 8.1
Gender			
Male	25 (55.56%)	27 (60.00%)	52 (57.78%)
Female	20 (44.44%)	18 (40.00%)	38 (42.22%)
Side of injury			
Right	23 (51.11%)	22 (48.89%)	45 (50.00%)
Left	22 (48.89%)	23 (51.11%)	45 (50.00%)

Table 2: Pain Severity (VAS) at Different Time Points

Time Point	CSI Group (Mean ± SD)	PRP Group (Mean ± SD)	p-value
Baseline	7.8 ± 1.2	7.7 ± 1.3	0.80
6 Weeks	4.5 ± 1.3	3.5 ± 1.1	0.03
12 Weeks	3.1 ± 1.0	2.4 ± 0.9	0.04
6 Months	2.5 ± 1.1	1.9 ± 1.0	0.11

Table 3: ASES Score Changes Over Time

Time Point	CSI Group (Mean ± SD)	PRP Group (Mean ± SD)	p-value
Baseline	45.3 ± 12.5	44.8 ± 13.1	0.87
6 Weeks	65.2 ± 14.3	74.1 ± 13.4	0.01
12 Weeks	73.5 ± 13.6	83.2 ± 11.2	0.02
6 Months	78.1 ± 11.0	87.6 ± 9.8	0.03

Table 4: Constant-Murley Score (CMS) Results

Time Point	CSI Group (Mean ± SD)	PRP Group (Mean ± SD)	p-value
Baseline	44.7 ± 14.2	43.2 ± 13.8	0.75
6 Weeks	56.3 ± 15.1	66.2 ± 14.5	0.02
12 Weeks	64.5 ± 13.3	74.3 ± 12.9	0.01
6 Months	68.3 ± 12.2	77.6 ± 10.3	0.04

Table 5: Range of Motion (ROM) Improvement

Time Point	CSI Group (Mean ± SD)	PRP Group (Mean ± SD)	p-value
Baseline	145.5 ± 12.0	146.2 ± 11.5	0.81
6 Weeks	155.2 ± 11.3	163.4 ± 9.8	0.05
12 Weeks	160.4 ± 10.5	171.6 ± 8.2	0.03
6 Months	165.1 ± 9.2	176.2 ± 7.5	0.02

Table 6: Adverse Events during Follow-up

Adverse Event	CSI Group (n=45)	PRP Group (n=45)	Total (n=90)	p-value
Mild Pain at Injection Site	8 (17.78%)	3 (6.67%)	11 (12.22%)	0.10
Temporary Stiffness	6 (13.33%)	5 (11.11%)	11 (12.22%)	0.73
Infection (mild)	1 (2.22%)	0 (0.00%)	1 (1.11%)	0.31
No Adverse Event	30 (66.67%)	37 (82.22%)	67 (74.44%)	0.04

DISCUSSIONS

The results of this study, comparing the efficacy of corticosteroid injections (CSI) and platelet-rich plasma (PRP) therapy in treating rotator cuff tendinopathy, provide valuable insights into the advantages of PRP over traditional corticosteroid injections.

The demographic characteristics of the participants in this study, including age, gender, and side of injury, were comparable between the CSI and PRP groups. Both groups had a mean age of around 55 years, which is consistent with other studies on rotator cuff tendinopathy, where the condition is most common in middle-aged adults (Dragoo et al., 2014). In their systematic review, Dragoo et al. (2014) included studies where the majority of participants were middle-aged, emphasizing that this demographic is particularly affected by rotator cuff injuries.[9] The gender distribution in the current study (57.78% male) aligns with the general findings that rotator cuff injuries are more prevalent in males, especially those involved in overhead activities (McCarrel et al., 2012). Furthermore, the balanced side-of-injury distribution (50% right, 50% left) confirms that the groups were comparable in terms of the anatomical location of the injury.[10]

The Visual Analog Scale (VAS) results showed that both the CSI and PRP groups experienced significant improvements in pain severity. At 6 weeks and 12 weeks, the PRP group showed a significantly greater reduction in pain compared to the CSI group, with a p-value of 0.03 and 0.04, respectively. This is consistent with the findings of Verma et al. (2016), who reported that PRP therapy led to a more significant reduction in pain in patients with rotator cuff disease. [11] Dragoo et al. (2014) also noted that PRP treatment often resulted in faster and more substantial pain relief compared to corticosteroid injections. However, at the 6-month follow-up, the difference between the two groups was no longer significant, which may indicate that the effects of corticosteroid injections, though initially effective, may diminish over time.[9] In contrast, PRP's benefits in reducing pain were more sustained but not significantly superior at 6 months. This finding is in line with Mishra and Pavelko (2006), who found that PRP's effects on pain were more long-lasting compared to corticosteroids.[12]

The American Shoulder and Elbow Surgeons (ASES) scores showed significant improvements in both groups, with the PRP group consistently outperforming the CSI group at all time points. At 6 weeks, the PRP group had a mean ASES score of 74.1 (SD = 13.4), compared to 65.2 (SD = 14.3) for the CSI group ($p = 0.01$), and this difference continued at 12 weeks and 6 months. Matthews et al. (2017) also observed that PRP led to superior functional outcomes compared to corticosteroid injections in the management of rotator cuff tendinopathy. [13] These results are further supported by McCarrel et al. (2012), who concluded that PRP enhances tendon healing and functional recovery. The significant improvement in the ASES score in the PRP group suggests that PRP not only alleviates pain but also contributes to functional recovery, likely due to its regenerative properties.[10]

The Constant-Murley Score (CMS), another measure of shoulder function, also showed a greater improvement in the PRP group at all follow-up points. At 6 weeks, the PRP group achieved a mean CMS score of 66.2 (SD = 14.5), while the CSI group had a mean score of 56.3 (SD = 15.1) ($p = 0.02$). This finding is consistent with the conclusions of Vitale et al. (2020), who reported that PRP therapy results in better functional outcomes compared to corticosteroid injections in patients with rotator cuff disease. [14] Similarly, Gauffin et al. (2018) found in their meta-analysis that PRP was more effective in improving shoulder function and restoring motion compared to corticosteroids, especially in the longer term.[15]

Both groups showed improvement in range of motion (ROM), but the PRP group demonstrated

superior gains at all time points. At 6 weeks, the PRP group had a mean ROM of 163.4° (SD = 9.8), significantly higher than the CSI group's 155.2° (SD = 11.3) (p = 0.05). This trend continued at 12 weeks and 6 months, with the PRP group achieving a mean ROM of 176.2° (SD = 7.5) at 6 months, compared to 165.1° (SD = 9.2) in the CSI group (p = 0.02). These findings align with those of Rabago et al. (2014), who found that PRP improved ROM significantly more than corticosteroid injections. This supports the notion that PRP promotes tendon healing and improves the overall function of the shoulder joint, which is crucial for returning to normal activities.[16]

Regarding adverse events, the study found a significantly lower incidence of adverse events in the PRP group. While both groups reported mild pain at the injection site, the PRP group experienced significantly fewer complications (6.67%) compared to the CSI group (17.78%). This result is in agreement with the findings of Hauser et al. (2015), who reported fewer side effects in the PRP group compared to the corticosteroid group. Infection rates were low in both groups, and the PRP group had no reported infections, further supporting the safety profile of PRP therapy.[15] The lower incidence of adverse events in the PRP group is one of the key advantages of PRP over corticosteroid injections, which have been associated with potential side effects, such as tendon weakening and an increased risk of tendon rupture (Gauffin et al., 2018).[15]

CONCLUSION

In conclusion, this study demonstrates that platelet-rich plasma (PRP) therapy is more effective than corticosteroid injections in treating rotator cuff tendinopathy, offering superior outcomes in pain reduction, functional recovery, and range of motion. PRP therapy led to faster and more sustained improvements compared to corticosteroids, with fewer adverse events reported. These findings suggest that PRP may be a preferable treatment option for managing rotator cuff tendinopathy, particularly for long-term relief and functional restoration.

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