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Incidence of Adhesive Capsulitis following Platelet Rich Plasma (PRP) Injection for Rotator Cuff Tendonopathy: A Retrospective Review

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Abstract

Context: Platelet-rich plasma (PRP) is increasingly used for rotator cuff tendinopathy due to its potential to enhance tissue healing and improve patient reported outcomes. Overall, there are few adverse outcomes reported following PRP. However, it is theorized that its pro-inflammatory effects may contribute to adverse outcomes, including adhesive capsulitis (AC). The purpose of this study is to evaluate the incidence of adhesive capsulitis following PRP injection for rotator cuff tendinopathy and to identify associated risk factors.

Design: Retrospective Cohort

Methods: A retrospective chart review was conducted at a large academic medical center, identifying patients who underwent PRP injections for rotator cuff tendinopathy between January 2022 and September 2025. Inclusion criteria included symptomatic tendinopathy refractory to conservative management with imaging confirmation. Patients with full-thickness rotator cuff tears or glenohumeral arthritis were excluded. The primary outcome was development of AC within three months of injection. Associations between patient characteristics, injection variables, and AC were analyzed using t-tests and chi-square tests.

Results: Seventeen patients (21 injections) were included. Five patients (29.4%) developed AC within three months of PRP injection. There were no significant differences in age or BMI between groups. Among patients without pre-existing AC, three cases (20%) of new-onset AC occurred, all in patients who received concomitant glenohumeral joint injections (3/7 vs. 0/8; $p = 0.038$). Female sex was significantly associated with AC development (57.1% vs. 10%; $p = 0.036$). Two patients with pre-existing signs of capsulitis progressed to clinically significant AC following injection.

Conclusion: Adhesive capsulitis occurred in a notable proportion of patients following PRP injection for rotator cuff tendinopathy, particularly among females and those receiving glenohumeral injections. Patients with pre-existing capsular symptoms may be at elevated risk. These findings underscore the importance of careful patient selection, pre-procedural screening, and counseling. Larger prospective studies are needed to better define this risk.

Keywords: Platelet Rich Plasma; PRP; Rotator Cuff Tendinopathy; Adhesive Capsulitis

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Introduction

Shoulder pain is one of the most common musculoskeletal complaints in the healthcare setting and represents a significant proportion of musculoskeletal disability worldwide [1]. Overall, lifetime estimates of shoulder pain can range from 14-67% each year, depending on the setting, with increasing prevalence in the elderly population [1-6]. Of patients with shoulder pain, rotator cuff tendinopathies represent one of the leading causes, with reported prevalence increasing with age, ranging from 10% to 60% [1,7]. Some studies indicate that rotator cuff disorders are identified as the etiology in over 80% of patients presenting for evaluation of shoulder pain [8,9]. Current management options for rotator cuff tendinopathies depend on type of tendinopathy (tendinitis, chronic tendinopathies, or partial versus full thickness rotator cuff tears) but can range from conservative measures to surgical intervention. The primary objective of tendinopathy treatments includes restoration of function and reduction of pain. Conservative treatments typically include a multimodal treatment regime including physical therapy, anti-inflammatory medications and injections. Despite these measures, recovery can be lengthy, taking 10 months for full recovery on average [10]. Surgery has not been shown to be superior to conservative treatment alone [11]. Given this, there continues to be greater interest in the development of effective adjunctive and possible disease modifying therapies for rotator cuff tendinopathies.

In recent years, there continues to be a growing interest in the use of orthobiologic therapies for treating tendinopathies. One such injectate is platelet rich plasma (PRP). PRP is an autologous blood injectate that consists of supraphysiologic levels of platelets [12-13]. PRP contains numerous growth factors and other cytokines that are theorized to help modulate the inflammatory response as well as the tissue healing response [14-16]. It is thought that tendinopathies have prolonged healing times due to limited vascularity and blood supply of the tendons. Various preclinical and animal studies have shown that by causing a transient inflammatory response via the TNFα and NFκB pathways, platelet rich plasma (PRP) injections help proliferation of different cells including tenocytes and myocytes [17-19]. Additionally, experiments on rat Achilles tendons showed that platelet derived growth factors stimulated healing and improved biomechanical strength by their effects on early stages of healing [17-19]. Given both pre-clinical and clinical study results, PRP injections are frequently being used to treat rotator cuff tendinopathies. Recent clinical studies have shown some promise, but varying formulations, small sample sizes and publication bias remain limiting factors for broad acceptance of PRP as an effective treatment for rotator cuff tendinopathy [20].

To this point, only one study has shown a significant increase in adverse events with PRP for rotator cuff injuries, noting an increase in rates of adhesive capsulitis (AC) and extension of the lesion when injected into interstitial supraspinatus tears when compared to saline injection (9). Despite the overall low rate of reported adverse events to date, it stands to reason that AC could be a common outcome after PRP injection. AC starts with a painful, inflammatory phase where patients have increased levels of (IL)-1α, IL-1β, tumor necrosis factor (TNF)-α, and COX-1 and COX-2, in capsular and subacromial bursal tissue [21]. The patient then undergoes a thickening of the synovial membrane with adherence to soft tissues, and ultimately there is extensive loss of movement in the joint, with arthroscopy showing fully developed scar tissue and adhesions. In patients with an already damaged rotator cuff tendon, introducing a pro-inflammatory state with a PRP injection, even if transient, may form the substrate necessary to start the inflammatory cascade of AC. Therefore, the primary aim of this study was to examine the incidence of AC after PRP for rotator cuff tendinosis.

Methods

Study Design

A retrospective chart review design was implemented in order to identify patients who underwent PRP injection into the rotator cuff at a large academic medical center in the southeast United States. This study was approved by the institutional review board (IRB # 00009014). Patients were identified as those who underwent PRP injections between January 2022 to September 2025. Eligible participants met the following inclusion criteria: 1) Male or female patients suffering from symptomatic rotator cuff tendinopathy despite conservative measures (i.e. physiotherapy, rest, oral analgesics), 2) radiographic evidence of tendinopathy obtained via Ultrasound (US) or MRI. The following exclusion criteria was used during patient selection: 1) Patients who have evidence of full thickness rotator cuff tear on imaging, and 2) Patients who had evidence of glenohumeral arthritis at baseline.

Patient Outcome

All patients were evaluated through retrospective chart review. Information regarding each identified patient was collected through an a priori developed data extraction sheet. The data extraction sheet consisted of 21-items which included baseline demographic information, diagnosis and treatment information, and outcome and adverse event information. The primary outcome of this study was incidence of adhesive capsulitis.

Statistical Methods

Descriptive statistics were used to summarize patient characteristics and treatment data. All continuous variables,

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including age and body mass index (BMI), were reported as means with standard deviations (SD). Differences in continuous variables between patients who developed adhesive capsulitis (AC) following platelet-rich plasma (PRP) injection and those who did not were evaluated using independent samples *t*-tests.

Categorical variables were summarized using frequencies and percentages. Associations between categorical variables and the development of AC were assessed using Pearson chi-square tests. Specifically, chi-square analyses were performed to evaluate the relationship between development of AC and (1) receipt of glenohumeral PRP injection among patients without pre-existing signs of adhesive capsulitis and (2) patient sex.

All statistical tests were two-sided, and statistical significance was defined as a p-value < 0.05. Statistical analyses were performed using RStudio (R Foundation for Statistical Computing, Vienna, Austria).

Results

A total of 17 patients received 21 PRP injections for rotator cuff tendinopathy. Of the 17 included patients, five were diagnosed with adhesive capsulitis (AC) following injection (n = 5, 29.4%), all within three months of treatment. There were no significant differences in baseline age between patients who developed AC (mean 64.0 ± 11 years) and those who did not (mean 60.0 ± 12 years; t = 0.64, p = 0.53). Similarly, body mass index (BMI) did not differ significantly between the AC group (25 ± 3.2 kg/m²) and the non-AC group (27 ± 3.2 kg/m²; t = 0.82, p = 0.43).

Two patients who developed AC (one male and one female) demonstrated clinical signs consistent with adhesive capsulitis prior to injection. In one of those patients, pain scores worsened after PRP. In the other, pain scores improved but range of motion remained limited (Table 1).

Table 1: Baseline and Injection Characteristics Stratified by Development of Adhesive Capsulitis.

Variable	AC (n = 5)	No AC (n = 12)	P Value
Age, mean ± SD (years)	64.0 ± 11.0	60.0± 12.0	0.53
Sex, n (%)			
Male	1 (20.0%)	9 (75.0%)	
Female	4 (80.0%)	3 (25.0%)	**0.036**
BMI, mean ± SD (kg/m²)	25.0 ± 3.2	27.0 ± 3.2	0.43
Tendinopathy Type, n (%)			
Chronic	4 (80.0%)	3 (25.0%)	
Acute	1 (20.0%)	9 (75.0%)	
PRP Volume (mL), mean ± SD	5.9 ± 2.2	4.3 ± 2.0	

Among patients without pre-existing signs of AC, three cases of new-onset AC occurred following treatment. All three cases occurred in patients who received glenohumeral PRP injections in addition to rotator cuff tendon injections. Among patients without baseline AC, seven received glenohumeral injections, resulting in three cases of AC, while eight patients did not receive glenohumeral injections and none developed AC. This difference was statistically significant ($\chi^2 = 4.29$, $p = 0.038$).

Sex was also significantly associated with the development of AC following PRP injection. Of the five patients diagnosed with AC, four were female and one was male. In contrast, among the twelve patients who did not develop AC, nine were male and three were female. Female sex was therefore significantly associated with post-injection AC ($\chi^2 = 4.4$, $p = 0.036$).

Discussion

Overall, our study demonstrated that 29.4% of patients undergoing PRP for rotator cuff tendinopathy were diagnosed with adhesive capsulitis within 3 months of treatment. These findings indicate that the incidence of AC after PRP for rotator cuff tendinosis may be much higher than previously thought, with recent reviews of the literature on the topic concluding that there are no adverse events associated with its use [22].

Mechanistically, AC is caused by capsular inflammation in a period of shoulder immobility. PRP injections are pro-inflammatory by design and can be quite painful for patients for days to weeks after the injection, potentially leading them to use their shoulders less. It stands to reason then that PRP could lead to development of AC in patients who are already at-risk. The results of this study align with this, demonstrating that both patients with early signs of capsulitis prior to injection went on to develop AC after injection.

However, three patients without pre-existing signs of AC on physical exam developed AC in this study (20%) after their injections. One thing they all had in common was that they received a glenohumeral joint PRP injection as part of their treatment. Additionally, all three of these patients were female and above the age of 45, consistent with the demographics of patients known to be most at-risk for AC [23]. Introducing pro-inflammatory injectate into the capsule may not lead to AC in all patients, but in patients who are already at high risk for AC it may lead to increase activation of the inflammatory cascade which may increase risk of development. Notably, no patients in the study who did not exhibit signs of AC prior to the injection nor receive a GH joint injection developed AC.

Overall, these findings indicate that patient selection may need to be considered prior to administering PRP injections for rotator cuff tendinosis. Patients with pre-existing signs of capsulitis on exam appear to be at a very high risk for

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developing AC after PRP injection, though larger studies with a higher sample size will be needed to confirm this. Additionally, it appears that those who had glenohumeral joint injections in addition to their tendon injections are also at higher risk than those who received tendon injections alone, and patients with known risk factors for AC should be educated on elevated risk of development of AC if the clinician opts to pursue PRP. It is likely that some risk of AC development in these patients can also be mitigated with adequate pain control, early range of motion, and structured physical therapy post-injection to avoid the shoulder immobilization component of the development of AC. It is important, however, to remind patients to avoid NSAIDs and ice after injection to not counter the desired pro-inflammatory effects of the injectate. This delicate balance will also require further research to establish an optimal regimen.

Limitations

The results of this study must be interpreted in the confines of its limitations. The primary limitation of this study was the small sample size of 17 patients. Larger studies will be required to confirm the findings. However, given the clear correlation of the data with the speculated mechanisms by which PRP for rotator cuff tendinosis may cause PRP, as well as the statistically significant findings, this study alone does raise enough concerns to consider more careful selection of patients. Additional limitations include lack of randomization of type of injection delivered (glenohumeral, tendon, or both) and lack of consistency in the volume of injectate injected. Future studies could investigate if volume of glenohumeral injectate is associated with development of AC post-injection, and if studies with larger sample sizes could better establish the true incidence of AC after PRP for rotator cuff tendinosis both in patients with and without pre-existing risk factors for AC, as well as in patients with and without glenohumeral PRP injection. Lastly, the retrospective design implemented in this study may introduce potential selection and documentation bias as AC diagnoses were dependent on clinical documentation rather than standardized prospective assessment.

Conclusion

In this retrospective cohort, a significant proportion of patients receiving platelet-rich plasma (PRP) injections for rotator cuff tendinopathy developed adhesive capsulitis within three months of treatment. The development of adhesive capsulitis was more frequently observed among female patients and among those who received PRP injections of the glenohumeral joint in addition to their rotator cuff tendon(s). Patients with pre-existing clinical signs of AC appeared to be at particularly elevated risk. These findings suggest that patient selection and injection location may influence the likelihood of post-injection adhesive capsulitis following PRP treatment for rotator cuff tendinopathy. Clinicians should consider screening for early signs of capsulitis prior to injection and counsel patients regarding the potential risk of this complication. Further prospective studies with larger sample sizes are needed to better define the incidence of adhesive capsulitis after PRP injection and to identify patient and procedural factors that may contribute to its development.

Ethics Approval:

This study was approved by the institutional review board (IRB # 00009014).

Data Availability Statement:

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests: No disclosures or competing interests to report.

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