Platelet-rich plasma injection for rotator cuff disease

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Clinical Inquiries question

Is platelet-rich plasma (PRP) injection an effective treatment for rotator cuff disease?

Evidence-based answer

In non-operative treatment of rotator cuff injuries, PRP injection did not improve functional outcomes or pain scores when compared with saline solution placebo, dry needling, or corticosteroid injection (strength of recommendation A: systematic review of randomized controlled trials [RCTs] with some methodologic flaws). Surgical adjunctive PRP injection inconsistently produced statistically significant improvements in pain and function of minimal clinical significance (less than 5%) (strength of recommendation B: systematic review of RCTs). Overall, PRP injection in the treatment of rotator cuff disease showed inconsistent results with moderate to high risk of bias.

Box 1. Orthopedic assessments and scales

Western Ontario Rotator Cuff Index
- 21-question survey, where each question is ranked from 0 to 100. The scores are split into 4 components (physical symptoms; sports, recreation, or work; lifestyle; and emotion) to assess quality of life

Shoulder Pain and Disability Index
- 13-item patient-completed instrument with 2 sections: pain and disability. Total scores range from 0 to 130; a percentage score of 0 indicates less shoulder disability and 100 indicates more shoulder disability

Visual analogue scale
- Subjective measure for acute and chronic pain from a handwritten mark on a 10-cm line scored 0 to 10 that represents a continuum from no pain to worst pain

Disabilities of the Arm, Shoulder and Hand
- 30-item (5-point Likert scale) self-reported questionnaire with a range from 0 (no disability) to 100 (most severe disability)

American Shoulder and Elbow Surgeons
- 100-point scale with 2 dimensions: pain and activities of daily living

Constant-Murley Score
- 100-point scale with 4 dimensions: pain, activities of daily living, range of motion, and strength

Simple Shoulder Test
- 12 yes or no questions scored from 0% to 100%

University of California Los Angeles Shoulder Scale
- Categories include active forward flexion, strength of forward flexion, pain, satisfaction, and function, scored from 0 to 35 with 0 indicating worse shoulder function

Evidence summary

A systematic review of 5 RCTs (N=214, 108 injected with PRP and 106 controls) compared PRP injection with saline solution injection, formal exercise therapy, dry needling, or corticosteroid injection. Overall, 61.6% of participants were female. Non-randomized studies, retrospective studies, reviews, laboratory studies, non–English language studies, and non–peer-reviewed studies were excluded. Studies using PRP injection as a surgical adjunct were also excluded. Incomplete outcome data limited 4 of the 5 studies.[1]

In 1 of the 5 RCTs comparing PRP injection to saline solution placebo, there was no significant difference in Western Ontario Rotator Cuff Index score, Shoulder Pain and Disability Index (SPADI) score, visual analogue scale (VAS) score, or range of motion (**Box 1** and **Table 1**).[1-5]

Two of the other RCTs compared PRP injection to formal exercise therapy. In 1 of these RCTs, at 1- and 3-month follow-up, VAS scores statistically significantly improved in the exercise therapy group compared to the PRP injection group. At 6-month follow-up, there was no significant difference in VAS score between the groups. At final follow-up, exercise therapy resulted in improved Western Ontario Rotator Cuff Index score and abduction range of motion, and there was no difference in Disabilities of the Arm, Shoulder and Hand (DASH) score (**Box 1**).[1]

In the second exercise-comparator RCT, participants were given weekly PRP injections for 3 weeks, with final follow-up at 1 year. Both groups had improved range of motion. Flexion, extension, abduction, and external rotation degrees were statistically significantly higher in the exercise therapy group than in the PRP injection group. Both groups had statistically significantly improved DASH scores, but there was no difference in DASH scores between the treatment groups at final follow-up. In both groups, VAS scores statistically significantly improved.[2]

A 2013 RCT compared PRP injection to dry needling. Both groups showed improvement in SPADI scores. Both groups achieved statistically significant improvement from 6 weeks to 6 months after initial injection. The authors reported that the PRP injection group had statistically significant improvement in their SPADI scores ($P<.05$) compared with the dry needling group. However, PRP injection did not produce significant differences in SPADI scores for total pain or for total disability.[3]

The final RCT compared PRP injection to corticosteroid injection. At 3 months, participants in the PRP injection group had better results compared with the

Table 1. Summary of RCTs

RCT COMPARATORS	NO. OF PATIENTS	ASSESSED USING ...	FINAL FOLLOW-UP, MO	MEAN CLINICAL OUTCOME	SUPERIOR TREATMENT	RISK OF BIAS
PRP injection vs saline solution injection[1]	40	SPADI, VAS, WORC Index	1	• SPADI: 14.6 vs 15.4; *P* > .05 • VAS: 0.8 vs 1.0; *P* > .05 • WORC Index: 85.6 vs 79.7; *P* > .05	Equal	Low
PRP injection vs exercise therapy[1]	42	DASH, VAS, WORC Index	6	• DASH: 33.0 vs 26.2* • VAS: 4.5 vs. 4.2* • WORC Index: 58.7 vs 73.1*	Exercise therapy	Moderate
PRP injection vs exercise therapy[2]	62	DASH, VAS	12	• DASH: 35.6 vs 36.4; *P* = .79 • VAS: 2.70 vs 2.59; *P* = .798	Equal	Moderate
PRP injection vs dry needling[3]	30	SPADI, VAS	6	• SPADI: PRP injection from 62.3 to 17.7 vs dry needling from 62.8 to 29.5	PRP injection, but both were clinically effective	Moderate
PRP injection vs corticosteroid injection[1]	40	ASES, CMS, SST	6	• ASES: 83.4 vs 78.9; *P* > .05 • CMS: 90.5 vs 87.3; *P* > .05 • SST: 10.2 vs 9.2; *P* > .05	Equal	High
PRP injection with surgery vs surgery without PRP injection[4]	781	ASES, CMS, UCLA Shoulder Scale, VAS	1.5 to 24	• ASES: MD 1.22 (-0.65 to 3.09); *P* = .20 • CMS: MD 2.65 (0.90 to 4.41)† • UCLA Shoulder Scale: MD 1.39 (0.61 to 2.17)† • VAS: MD -0.22 (-0.37 to -0.06)†	PRP injection for 3 of the 4 measures	Moderate
PRP injection with surgery vs surgery without PRP injection[5]	1116	ASES, CMS, SST, UCLA Shoulder Scale, VAS	6.5 to > 12	• ASES: WMD 0.74 (-0.77 to 2.24); *P* > .05 • CMS: WMD 1.80 (0.63 to 2.96)† • SST: WMD 0.23 (-0.07 to 0.53) • UCLA Shoulder Scale: WMD 0.97 (0.23 to 1.70) • VAS: WMD -0.27 (-0.51 to -0.04)*	Inconsistent and not clinically important	Moderate

ASES—American Shoulder and Elbow Surgeons; CMS—Constant-Murley Score; DASH—Disabilities of the Arm, Shoulder and Hand; MD—mean difference; PRP—platelet-rich plasma; RCT—randomized controlled trial; SPADI—Shoulder Pain and Disability Index; SST—Simple Shoulder Test; UCLA—University of California Los Angeles; VAS—visual analogue scale; WORC—Western Ontario Rotator Cuff; WMD—weighted mean difference.
*Statistically significant in favour of control.
†Statistically significant in favour of PRP injection.

corticosteroid injection group on the American Shoulder and Elbow Surgeons assessment, the Constant-Murley Score (CMS), the Simple Shoulder Test, and the VAS (**Box 1**). However, at 6 months, which was the final follow-up, no significant difference occurred in any of the outcome measures.[1]

Platelet-rich plasma injection as a surgical adjunct. A meta-analysis looking at PRP injection as an adjunct to arthroscopy repair of rotator cuff tears included 12 RCTs (N = 781 patients; 391 PRP injected and 390 control). Overall, 54.7% of participants were female. Inclusion criteria included RCTs or quasi-RCTs published in English

in a peer-reviewed journal. Non-randomized, retrospective, review, and basic science studies were excluded. The authors rated the reviewed studies—using the Jadad 5-point scale—as at low risk of bias, despite 10 of the 12 studies not using control injections.[4]

Platelet-rich plasma injection scores were 2.5% better than control on the CMS (85.6 for PRP injection vs 83.1 for control; $P<.05$), 2.8% better than control on the University of California Los Angeles Shoulder Scale (**Box 1**; 30.9 for PRP injection vs 29.9 for control; $P<.05$), and 14% better than control on a VAS 30 days after the operation (2.9 for PRP injection vs 4.3 for control; $P<.05$) and 2% better at final follow-up (1.2 for PRP injection vs 1.4 for control; $P<.05$).[4]

A second meta-analysis with 17 RCTs evaluated surgical adjunct PRP injection versus surgical repair without PRP injection (N=1116 patients; 545 PRP injection and 571 control). Overall, 55.7% of participants were female. Exclusion criteria included non–English language articles and non–level 1 studies. Follow-up time varied between short term (up to 6.5 months of follow-up) and long term (>1 year of follow-up, if available). The data were assessed using funnel plots and Egger tests; potential publication bias complicated by small study effects was found for the University of California Los Angeles Shoulder Scale and the VAS.[5] Long-term re-tear rates greatly decreased in groups treated with PRP injection. Several patient-reported outcome measures (CMS, VAS), healing rates, and pain levels were higher in PRP-injected patients, but this meta-analysis noted failure to reach a clinically important difference.[5]

Recommendations from others

The American Academy of Orthopaedic Surgeons lists PRP injection in the treatment of rotator cuff disease as a limited-evidence recommendation, citing variability in high-quality study findings.[6]

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Competing interests
None declared

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References

1. Hurley ET, Hannon CP, Pauzenberger L, Fat DL, Moran CJ, Mullett H. Nonoperative treatment of rotator cuff disease with platelet-rich plasma: a systematic review of randomized controlled trials. *Arthroscopy* 2019;35(5):1584-91. Epub 2019 Apr 15.
2. Ilhanli I, Guder N, Gul M. Platelet-rich plasma treatment with physical therapy in chronic partial supraspinatus tears. *Iran Red Crescent Med J* 2015;17(9):e23732. Epub 2015 Sep 28.
3. Rha DW, Park GY, Kim YK, Kim MT, Lee SC. Comparison of the therapeutic effects of ultrasound-guided platelet-rich plasma injection and dry needling in rotator cuff disease: a randomized controlled trial. *Clin Rehabil* 2013;27(2):113-22. Epub 2012 Oct 3.
4. Hurley ET, Lim Fat D, Moran CJ, Mullett H. The efficacy of platelet-rich plasma and platelet-rich fibrin in arthroscopic rotator cuff repair: a meta-analysis of randomized controlled trials. *Am J Sports Med* 2019;47(3):753-61. Epub 2018 Feb 21.
5. Chen X, Jones IA, Togashi R, Park C, Vangsness CT Jr. Use of platelet-rich plasma for the improvement of pain and function in rotator cuff tears: a systematic review and meta-analysis with bias assessment. *Am J Sports Med* 2020;48(8):2028-41. Epub 2019 Nov 19.
6. OrthoGuidelines. *Platelet rich plasma (PRP) injection in partial-thickness tears. Limited evidence does not support the routine use of platelet rich plasma for the treatment of cuff tendinopathy or partial tears.* Rosemont, IL: American Academy of Orthopaedic Surgeons; 2019. Available from: **http://www.orthoguidelines.org/guideline-detail?id=1468**. Accessed 2020 May 5.