Descriptive analysis of platelet-rich plasma injection therapy in chronic musculoskeletal pain

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ABSTRACT

Introduction: Platelet-rich plasma (PRP) injections have been used to manage various chronic pain conditions. However, evidence remains limited due to poor standardisation across practices. In this descriptive study, we aimed to characterise current PRP practice patterns at a university-affiliated private pain clinic in Hong Kong, focusing on case mix and treatment outcomes in patients with chronic musculoskeletal pain.

Methods: This retrospective descriptive study included patients with diverse chronic musculoskeletal pain conditions aged 18 years or older who attended the Peter Hung Pain Specialist Clinic and received PRP injection therapy between January 2023 and December 2024. Improvements in pain and changes in oral analgesic use were recorded.

Results: In total, 248 patients were included. Prior to PRP treatment, over 70% required multiple oral analgesics for pain control, including 55.6% taking antidepressants, 41.5% gabapentin or pregabalin, and 25.8% oral opioids. At first follow-up (median: 4 weeks, range: 1-20), more than 60% reported 'moderate' or 'much' improvement in pain symptoms. By 12 months post-treatment, fewer than 10% of patients in each category continued to require oral opioids, antidepressants, gabapentin, or pregabalin. Of the 26 patients (10.5%) who required a second PRP session, only one reported no improvement.

Conclusion: These results highlight the potential utility of PRP in managing chronic musculoskeletal pain and underscore the need for randomised controlled trials to confirm its long-term impact on quality of life of patients.

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New knowledge added by this study

- Musculoskeletal pain is a common clinical manifestation in Hong Kong.
- Leukocyte-rich platelet-rich plasma (PRP) provided convincing pain improvement across various types of musculoskeletal pain, with reduction or discontinuation of oral analgesics.
- The effect of PRP injection was more pronounced in patients with a shorter duration of chronic pain.

Implications for clinical practice or policy

- Randomised controlled trials with standardised PRP preparation in specific patient groups are needed.
- Platelet-rich plasma injection may be beneficial for chronic pain; however, further evidence is required.

Introduction

Platelet-rich plasma (PRP) refers to plasma with a platelet concentration higher than that found in whole blood. It is classified into four types based on its leukocyte and fibrin content: leukocyte-rich or -poor, and fibrin-rich or -poor.[1] Initially used by haematologists in the 1970s as platelet transfusions for thrombocytopenia, PRP gained traction in the 1980s in maxillofacial surgery and sports medicine due to its potential anti-inflammatory effects.[2] Since then, its applications have extended to regenerative medicine and pain management because of its abundance of growth factors and cytokines.[3] Despite its widespread use in degenerative and pain conditions—such as osteoarthritis, low back pain, and tendinitis—evidence for PRP efficacy in humans remains limited and controversial.[4,5] Understanding of PRP practice and efficacy among anaesthetists is particularly scarce. This study aimed to characterise current PRP practice patterns at a university-affiliated private pain clinic in Hong Kong, focusing on case mix and treatment outcomes in patients with chronic musculoskeletal pain.

高濃度血小板血漿注射治療慢性肌肉骨骼疼痛的描述性分析

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引言：高濃度血小板血漿注射已被用於治療各種慢性疼痛疾病。然而，由於不同臨床操作之間缺乏標準化，相關證據仍然有限。本描述性研究旨在探討一間隸屬大學的香港私人疼痛專科診所現行的高濃度血小板血漿臨床實踐模式，重點分析慢性肌肉骨骼疼痛患者的病例組合及治療成效。

方法：本回顧性描述性研究納入2023年1月至2024年12月期間，年滿18歲並於洪克協痛症專科門診接受高濃度血小板血漿注射治療的慢性肌肉骨骼疼痛患者。研究記錄其疼痛改善情況及口服止痛藥使用的變化。

結果：本研究共納入248名患者。接受治療前，超過70%患者需同時使用多種口服止痛藥控制疼痛，其中55.6%服用抗抑鬱藥，41.5%服用加巴噴丁或普瑞巴林，25.8%服用口服鴉片類止痛藥。於首次隨訪時（中位數4星期，介乎1-20星期），超過60%患者報告疼痛症狀有「中度」或「顯著」改善。治療後12個月，各類別中持續需要口服鴉片類止痛藥、抗抑鬱藥、加巴噴丁或普瑞巴林的患者均少於10%。在26名（10.5%）需接受第二次高濃度血小板血漿注射治療的患者中，僅1人表示未見改善。

結論：研究結果顯示，高濃度血小板血漿在治療慢性肌肉骨骼疼痛方面具有潛在效益，並強調有需要進行隨機對照試驗，以確認其對患者生活質素的長遠影響。

Methods

Study population

This study included patients aged 18 years or older who attended the Peter Hung Pain Specialist Clinic and received PRP injection therapy for chronic pain between January 2023 and December 2024. Patients were excluded if they were younger than 18 years, had been diagnosed with cancer-related pain, or did not proceed with PRP therapy after pain assessment.

Leukocyte-rich PRP was prepared by collecting autologous blood and subjecting it to two centrifugation cycles using sterile technique and an Eppendorf Centrifuge 5702 (Eppendorf SE, Hamburg, Germany). Whole blood was first centrifuged at 3800 rpm for 2 minutes to sediment red blood cells and form a buffy coat-rich plasma layer, without excessive platelet loss into the erythrocyte fraction. The plasma/buffy coat fraction was then transferred and centrifuged again at 3800 rpm for 5 minutes, applying the same centrifugal force in longer duration to this less viscous, cell-reduced plasma to achieve further platelet sedimentation and centration while minimising platelet damage or premature activation. The same force with longer duration is considered having the same effect as higher force with shorter duration by the manufacturer. Each PRP injection session targeted all painful regions deemed suitable by the same attending pain specialist under monitored anaesthesia care or general anaesthesia.

Data were extracted from the pain clinic and hospital databases, including patient age, sex, sites and types of chronic pain, duration of pain prior to PRP therapy, use of pain medications, history of surgical or interventional procedures for pain, and the indications, locations, and dosage for each PRP treatment. Standard pain assessment for patients undergoing PRP therapy included evaluation of overall and site-specific pain improvement at follow-up visits. In this study, pain improvement at the first follow-up after PRP therapy was specifically assessed and categorised as 'no improvement', 'mildly improved', 'moderately improved', or 'much improved'. Additional outcomes included the proportion of patients able to discontinue oral analgesics and identification of factors associated with a favourable pain relief response to PRP therapy.

Statistical analyses

Results are presented as numbers (with percentages) and medians (with interquartile ranges [IQRs] and ranges). Categorical variables before and after PRP therapy were compared using the McNemar test. One-way analysis of variance was used to assess the association between the duration of chronic pain prior to PRP therapy and the likelihood of reporting 'much improved' pain at the first follow-up. Logistic regression analysis was conducted to determine whether specific pain pathologies or anatomical regions were associated with better responses to PRP therapy. All statistical tests were two-tailed and performed using SPSS (Windows version 29.0; IBM Corp, Armonk [NY], United States). A P value <0.05 was considered statistically significant.

Results

A total of 248 patients aged 20 to 97 years who received at least one session of PRP therapy during the study period were included. Of these, 61.3% were women. The duration of pain prior to PRP therapy varied widely, ranging from 1 month to over 20 years, with a median of 15 months. More than 70.2% of patients (n=174) were taking two or more analgesics before PRP therapy. Fourteen patients (5.6%) had previously received ketamine infusions for pain; two of these had undergone interventional procedures such as radiofrequency thermocoagulation of the trigeminal ganglion, ultrasound- and X-ray–guided radiofrequency with injection to the left glossopharyngeal nerve, and X-ray–guided steroid injection at the L4/5 level of the lumbar spine. Ninety patients (36.3%) reported pain in more than one anatomical region. Baseline characteristics, including analgesic use, are summarised in Table 1.

TABLE 1. Patient characteristics at baseline (n=248)*

Age, y	
Median (IQR)	63 (51-75)
Mean (range)	61 (20-97)
Sex	
Female	152 (61.3%)
Male	96 (38.7%)
Duration of chronic pain, mo	
Median (IQR)	15 (6-48)
Mean (range)	35 (1-360)
Diabetes mellitus	31 (12.5%)
Hypertension	49 (19.8%)
History of cancer†	13 (5.2%)
Chronic pain diagnoses/regions of pain‡	
Osteoarthritis	72 (29.0%)
Lower back or lumbosacral spine–related pain	112 (45.2%)
Gluteal pain	73 (29.4%)
Cervical spine–related pain	33 (13.3%)
Tendinitis	95 (38.3%)
Neuropathic pain (eg, after nerve injury or postherpetic neuralgia)	19 (7.7%)
Pain medications	
Cyclooxygenase inhibitors	107 (43.1%)
Opioids	64 (25.8%)
Antidepressants	138 (55.6%)
Gabapentin/pregabalin	103 (41.5%)
Ketamine infusion	14 (5.6%)

Abbreviation: IQR = interquartile range

* Data are shown as No. (%), unless otherwise specified

† Seven cases with a history of cancer were considered clinically in remission; three had active cancer with metastasis, and three had unclear status in the case notes

‡ Ninety patients (36.3%) had more than one chronic pain diagnosis and pain region on presentation for platelet-rich plasma injection therapy

Platelet-rich plasma therapy was administered to 404 anatomical sites across the 248 patients. The median volume of PRP injected during the first session was 17.0 mL (mean=18.3, IQR=10.0-20.5; range, 2-50). Twenty-six patients (10.5%) required more than one PRP session, with a median interval of 4.0 months (mean=4.0, IQR=2.8-5.0; range, 1-15). Seven patients (2.8%) received three sessions during the 2-year study period.

The median time to first follow-up after PRP therapy was 4.0 weeks (mean=4.5, IQR=4.0-4.5; range, 1-20). Thirty patients (12.1%) did not return for follow-up. Among the remaining 218 patients, over 60% reported their pain as either 'moderately improved' or 'much improved'. The distribution of pain relief levels is shown in Table 2. Among all factors assessed, only the duration of chronic pain prior to PRP therapy was significantly associated with the likelihood of reporting 'much improved' pain at first follow-up. Specifically, longer pain duration was inversely associated with improvement (odds ratio=0.91 per 6-month increment in pain duration prior to PRP therapy, 95% confidence interval=0.85-0.98; P=0.008) [Table 3]. Patients with chronic pain lasting less than 2 years appeared to respond best to PRP therapy (Fig). The volume of PRP injected was not significantly associated with reporting 'much improved' pain.

TABLE 2. Subjective pain relief rating compared with baseline at first follow-up after platelet-rich plasma therapy (n=218)*

Degree of improvement	No. of patients (%)	Cumulative percentage
Much improved	71 (32.6%)	32.6%
Moderately improved	64 (29.4%)	62.0%
Mildly improved	45 (20.6%)	82.6%
No improvement	38 (17.4%)	100%

The median time to second follow-up was 9.0 weeks (mean=9.7, IQR=8.0-11.0; range, 2-32). Over the 12-month period after PRP therapy, a substantial number of patients were able to discontinue oral analgesics (Table 4).

Discussion

In this descriptive study, over 60% of patients reported moderate to significant improvement in pain symptoms after their first PRP treatment session. Among the 26 patients who received a second session, only one reported no improvement, suggesting a favourable response to repeated treatment. This improvement was accompanied by a substantial reduction in the use of oral analgesics. Given the known adverse effects associated with polypharmacy—particularly involving antidepressants, gabapentinoids, and opioids—this reduction may contribute to improved quality of life of patients.

Our cohort included patients with a wide range of chronic pain conditions affecting various anatomical sites. Intriguingly, there was no apparent correlation between the number of pain sites and the degree of pain relief, suggesting that PRP may have broad applicability across multiple pain syndromes. However, due to the heterogeneity of pain presentations and the presence of multiple pain regions in many patients, we were unable to determine whether PRP was more effective for specific types or anatomical regions of pain. This highlights the need for future randomised controlled

trials involving more homogeneous patient populations to confirm the long-term impact of PRP on quality of life according to pain pathology.

TABLE 3. Logistic regression analysis of clinical factors associated with reporting chronic pain 'much improved' at first follow-up after platelet-rich plasma therapy (n=218)

	Odds ratio (95% confidence interval)	P value
Age	1.01 (0.99-1.03)*	0.570
Volume of platelet-rich plasma injected	0.98 (0.95-1.01)†	0.203
Chronic pain duration prior to first platelet-rich plasma therapy	0.91 (0.85-0.98)‡	0.008
Osteoarthritis	1.54 (0.64-3.68)	0.387
Gluteal pain	1.36 (0.49-3.81)	0.558
Neuropathic pain	0.94 (0.24-3.75)	0.935
Spine-related pain with radiculopathy	1.76 (0.70-4.43)	0.232
Spine-related pain without radiculopathy	0.77 (0.31-1.89)	0.562
Tendinitis	0.62 (0.23-1.70)	0.355
Ketamine use prior to platelet-rich plasma	1.16 (0.27-4.92)	0.841

* Per year increment
† Per mL increment
‡ Per 6-month increment

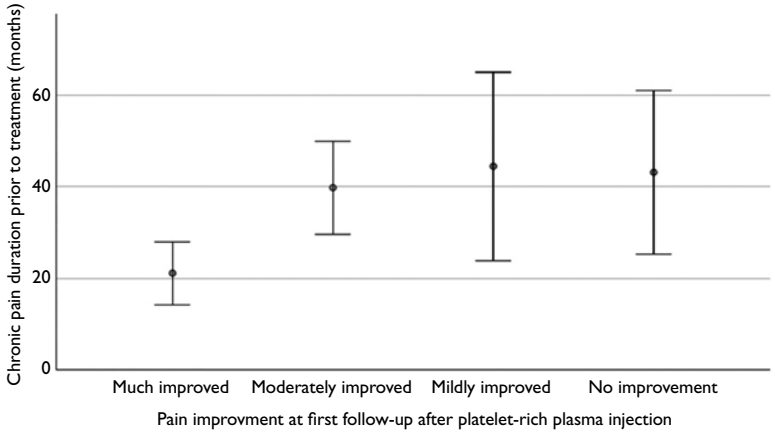

FIG. Association between chronic pain duration prior to treatment and reporting 'much improved' pain at first follow-up*
* P=0.025 by one-way analysis of variance

Although PRP therapy is considered a form of regenerative therapy,[3] its mechanisms of action are not yet fully understood.[5] Platelets contain granules that release a variety of bioactive substances, including growth factors, antimicrobial proteins, metalloproteases, coagulation factors, and membrane glycoproteins that influence the synthesis of interleukins and chemokines. Other bioactive molecules, including neurotransmitters such as serotonin, dopamine, adenosine diphosphate, adenosine triphosphate, and histamine, may also play roles in tissue modulation and regeneration.[4] Some research suggests that leukocyte-rich PRP has stronger anti-inflammatory effects and higher concentrations of growth factors, which may be important for conditions such as knee osteoarthritis.[6,7] However, evidence as to whether leukocyte-rich PRP is superior to leukocyte-poor PRP remains inconclusive. One of the largest randomised controlled trials assessing PRP for knee osteoarthritis concluded that leukocyte-poor PRP was not significantly more effective than placebo in improving symptoms or joint structure among patients with mild to moderate knee osteoarthritis over 12 months.[8] Conversely, a recent systematic review and meta-analysis found that leukocyte-poor PRP provided moderate pain relief compared with other active treatments; no significant difference was observed between leukocyte-rich PRP and other therapies.[5] In the present study, all patients received leukocyte-rich PRP; therefore, we were unable to compare the efficacy of different PRP formulations.

The data showed that 13 patients with a history of cancer (either active with metastasis, in remission, or with unclear status) received PRP for pain clinically unrelated to their cancers (Table 1). Currently, there is no strong evidence regarding the safety of PRP use in patients with cancer. A recent formal consensus from the International Research Group on Platelet Injections recommended that PRP may be performed in patients with cancers in remission or with metastasis—after discussion with an oncologist—although the supporting evidence is contradictory or inconclusive and largely based on expert opinion, with very limited or absent literature.[9]

TABLE 4. Differences in analgesic use before and after platelet-rich plasma therapy at 6- and 12-month follow-up (n=248)*

	Baseline	At 6 months	P value†	At 12 months	P value†
Cyclooxygenase inhibitors	107 (43.1%)	13 (5.2%)	<0.001	7 (2.8%)	<0.001
Opioids	64 (25.8%)	19 (7.7%)	<0.001	11 (4.4%)	<0.001
Antidepressants	138 (55.6%)	29 (11.7%)	<0.001	15 (6.0%)	<0.001
Gabapentin/pregabalin	103 (41.5%)	19 (7.7%)	<0.001	11 (4.4%)	<0.001

* Data are shown as No. (%), unless otherwise specified
† Compared with baseline

Limitations

This study has several limitations. First, without a control group, placebo effects cannot be excluded. Second, PRP dosing was not standardised; the volume administered varied according to the number and size of pain sites, and detailed documentation of per-site dosing was unavailable. Additionally, over 10% of patients did not return for follow-up, and reasons for loss to follow-up were not documented, introducing potential selection bias. The heterogeneity of pain conditions further complicated data interpretation. Although current evidence suggests that leukocyte-rich PRP may cause greater initial flare-up than leukocyte-poor PRP for intra-articular injections,[10] any initial worsening of symptoms was not captured in our study because of variability in the timing of first follow-up. Finally, pain improvement was assessed using non-standardised, subjective descriptors ('much improved', 'moderately improved', or 'mildly improved'). These terms reflect patient satisfaction but do not permit precise quantification of pain reduction. Future studies should incorporate validated quantitative assessment tools, such as the Brief Pain Inventory, to enhance the reliability of outcome measurement.

Conclusion

Leukocyte-rich PRP appeared effective in improving chronic musculoskeletal pain. The majority of patients reported meaningful symptom relief, and many were able to reduce or discontinue oral analgesics—an outcome that may substantially improve quality of life, particularly given the adverse effects associated with polypharmacy involving antidepressants, gabapentinoids, and opioids. Well-designed randomised controlled trials focusing on chronic musculoskeletal pain of less than 2 years' duration—and incorporating standardised protocols for leukocyte-rich PRP preparation, injection volume, and patient selection criteria—are needed to confirm its long-term impact on quality of life of patients.

Author contributions

Concept or design: MHM Chu, WS Chan, KM Ho.
Acquisition of data: WS Chan, HL Wong.
Analysis or interpretation of data: MHM Chu, KM Ho.
Drafting of the manuscript: MHM Chu, KM Ho.
Critical revision of the manuscript for important intellectual content: WS Chan, ACY Li, HMK Wong.

All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

Conflicts of interest

All authors have disclosed no conflicts of interest.

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Ethics approval

This research was approved by the Clinical Research Ethics Committee of CUHK Medical Centre, Hong Kong (Ref No.: CREC-202409). A waiver of patient consent was approved by the Committee due to the retrospective and observational nature of the study. Only de-identified data were used for analysis.

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