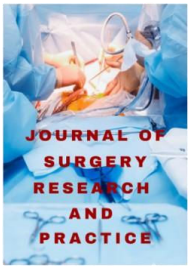

e-ISSN: 3068-3742
Journal of Surgery Research and Practice

ATHENAEUM SCIENTIFIC PUBLISHERS

Case Report

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Novel Use of Ultrasound (US) Arthrogram to Increase Robustness of Payload Delivery of Platelet-Rich Plasma (PRP) in the Hip Joint

Zane Sherif[1*], Ashton Padowitz[1], Bryce Allen[1], Kirralee Sherif[1]

[1]Mermaid Beach Radiology, Gold Coast, Australia

***Correspondence author:** Zane Sherif, Mermaid Beach Radiology, Gold Coast, Australia; Email: zanesherif@gmail.com

Citation: Sherif Z, et al. Novel Use of Ultrasound (US) Arthrogram to Increase Robustness of Payload Delivery of Platelet-Rich Plasma (PRP) in the Hip Joint. J Surg Res Prac. 2026;7(1):1-6.

https://doi.org/10.46889/JSRP.2026.7110

Received Date: 20-02-2026

Accepted Date: 05-03-2026

Published Date: 12-03-2026

Abstract

Background: Autologous Platelet-Rich Plasma (PRP) is increasingly used for the treatment of intra-articular hip pathology. Accurate sub-capsular needle placement is critical for therapeutic efficacy, but can be technically challenging using conventional Ultrasound (US) guidance due to limited needle visualization in difficult to access deep joints. Contrast-Enhanced Ultrasound (CEUS) arthrography may improve real-time confirmation of intra-articular needle position.

Case presentation: A man in their early 50s with a history of acute mechanical left hip pain and an MRI-confirmed labral tear who underwent autologous PRP therapy. PRP was prepared from 240 ml of whole blood, yielding approximately ~40 billion platelets with a high leukocyte concentration and no exogenous activation. Injection was performed under US guidance using microbubble contrast to generate a CEUS arthrogram of the joint.

Results: Prior to contrast entry, needle visualization was limited on B-mode and contrast-specific US imaging. Following intra-articular contrast dispersion, the joint space became markedly hyperechoic, allowing clear delineation of joint anatomy and improved visualisation of the needle shaft and tip. This enabled confident confirmation of intra-articular needle placement before PRP delivery.

Conclusion: CEUS arthrography improves real-time needle visualisation and confirmation of intra-articular access during ultrasound-guided hip injections. This technique may enhance procedural accuracy and safety for PRP delivery in deep joints.

Keywords: Platelet-Rich Plasma; Contrast-Enhanced Ultrasound; Hip Injection; Intra-articular Therapy

Introduction

Autologous Platelet-Rich Plasma (PRP) is widely used in regenerative medicine due to its high concentration of bioactive growth factors and cytokines. These include platelet-derived growth factors and Vascular Endothelial Growth Factor (VEGF), as well as anti-inflammatory mediators such as Transforming Growth Factor-Beta (TGF-β) and interleukin-10 (IL-10). A growing body of literature suggests that PRP provides superior pain reduction and functional improvement in a range of musculoskeletal pathologies when compared with alternative injectable therapies, including corticosteroids and hyaluronic acid [1].

Accurate sub-capsular delivery is particularly important when treating deep or anatomically complex joints such as the hip. Historically, subcapsular hip injections have been guided by Computed Tomography (CT) or fluoroscopy to confirm needle-tip placement, given the technical challenges associated with accessing the joint space [2]. This case report describes a novel technique of using a contrast-enhanced Ultrasound (US) arthrogram of the hip joint to improve visualisation of needle placement and enhance the precision of PRP delivery in a patient with symptomatic intra-articular hip pathology.

Case Description

A man in his early-50s presented with acute hip pain, stiffness and mechanical symptoms including crepitus. MRI revealed a labral tear of the left hip (Fig. 1). Following informed consent, the patient underwent autologous PRP therapy. PRP was prepared from 240 ml of whole blood, yielding a total platelet count of approximately 40 billion platelets with a high leukocyte concentration and no exogenous activation. This preparation corresponded to a PAW classification of P4-Aα [3]. The PRP was administered via ultrasound-guided intra-articular injection using microbubble contrast to perform a Contrast-Enhanced US (CEUS) arthrogram of the left hip joint.

US-guided technique: When accessing the femoral head via an anterior approach, a steeper angle is required to minimise the intratissue needle path length. This makes achieving a near-perpendicular insonation angle difficult, resulting in reduced needle visibility. In this case, an angle of approximately 57° was used, compared with a typically recommended angle of less than 30° reported in the literature [4]. Fig. 2 shows the annotated US window.

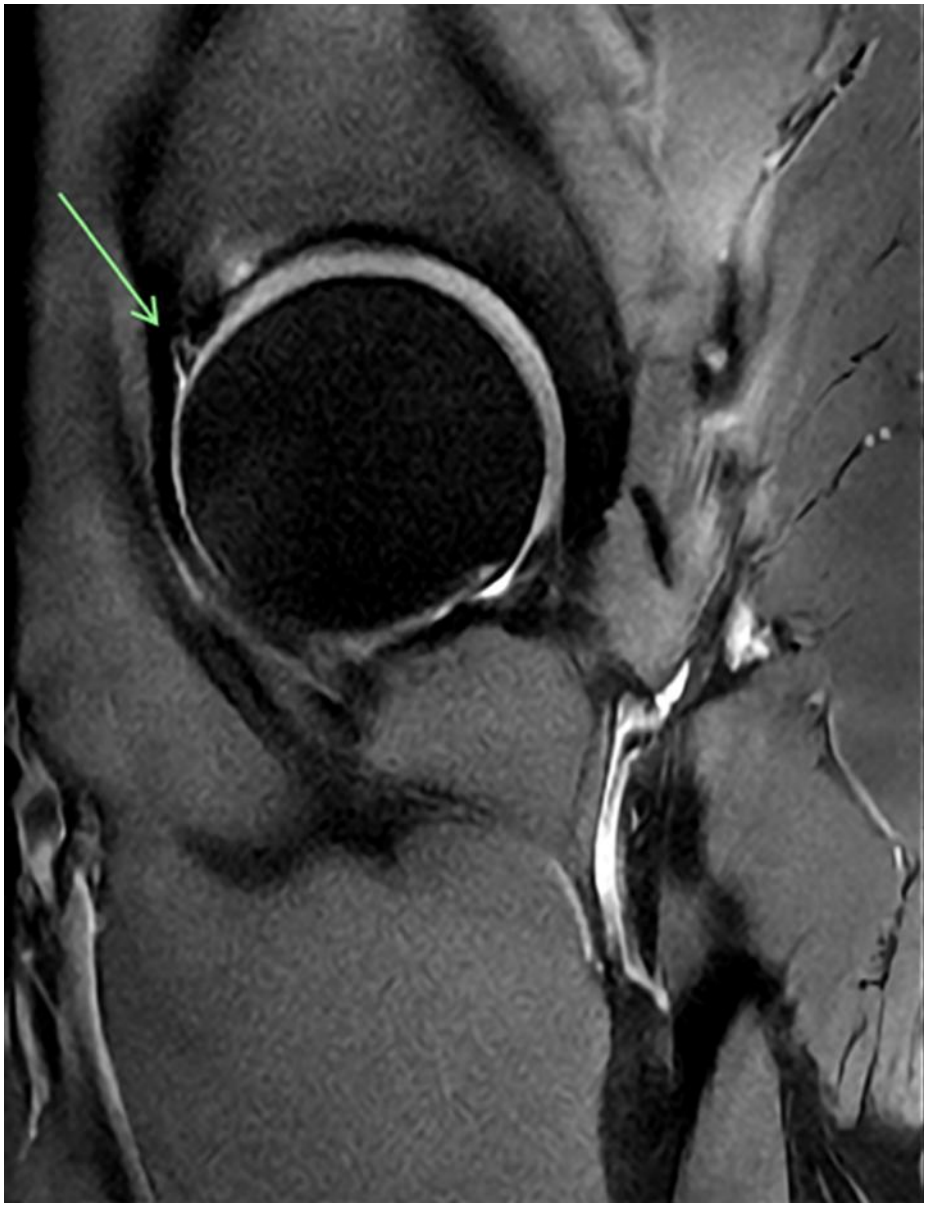

Figure 1: MRI Sagittal view of the left hip, arrow pointing at a labral tear.

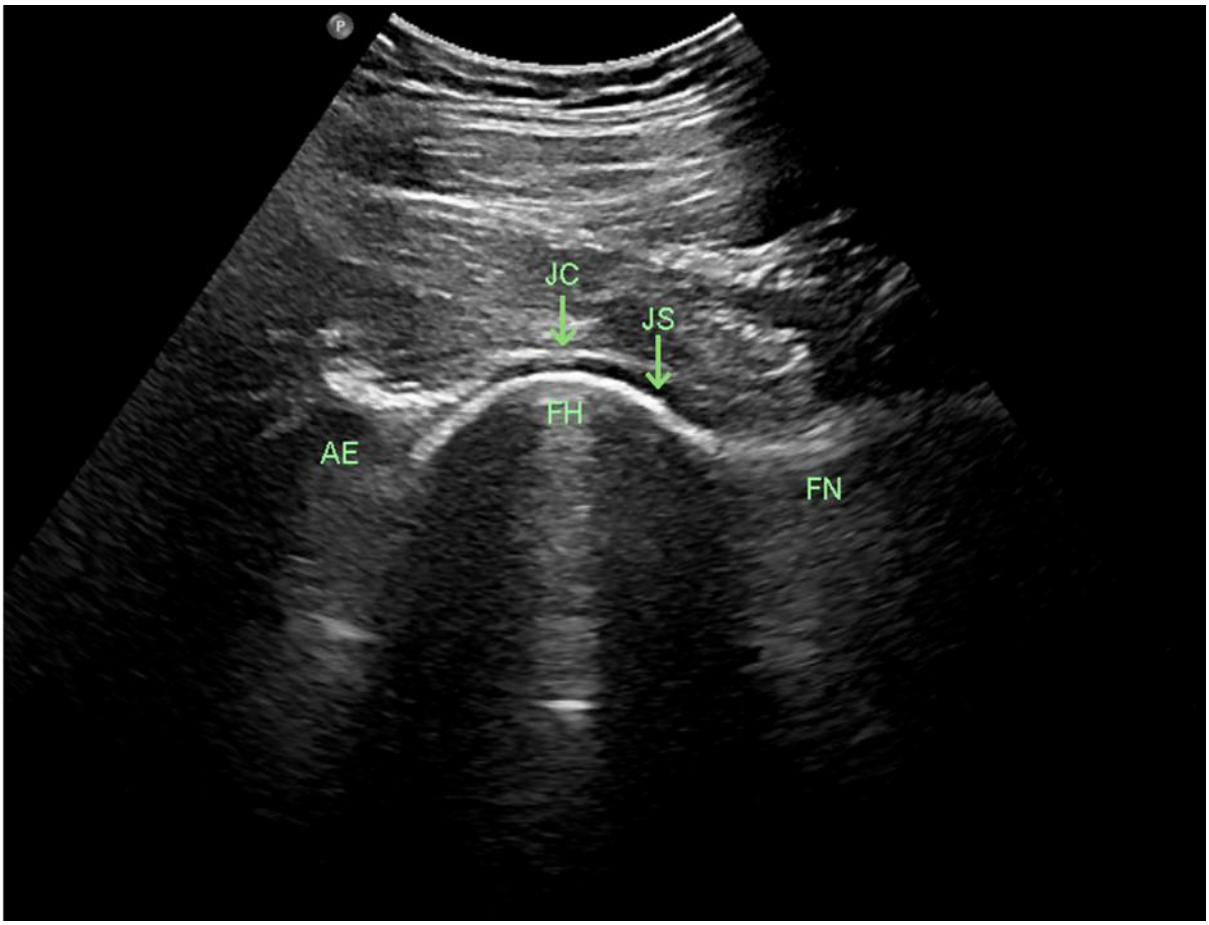

Figure 2: Annotation of left hip under US. Key: AE: Acetabular Edge, JS: Joint Space, FH: Femoral Head, FN: Femoral Neck, JC: Joint Capsule.

Discussion

Accurate visualisation of the needle during ultrasound-guided hip injection can be technically challenging. US guidance has traditionally been considered less reliable for deep joint injections due to the physical properties of US wave reflection. Needles are optimally visualised when the US beam strikes the shaft at a near-perpendicular angle. When the needle is inserted at steeper or oblique angles, reflection is reduced, rendering the needle difficult to visualise and increasing the risk of inadvertent vascular or neural injury [5]. For this reason, CT- and fluoroscopy-guided injections have been commonly employed to confirm intra-articular positioning. However, these modalities provide static images obtained after needle advancement, limiting real-time feedback. In contrast, US offers real-time imaging and dynamic needle tracking. The use of CEUS arthrogram further augments this capability [1]. Microbubble contrast agents, composed of perfluorocarbon, nitrogen or sulphur hexafluoride gas stabilised within a phospholipid shell, oscillate when exposed to a US beam. This oscillation generates strong echogenic signals, markedly improving visualisation of the joint space and needle position [6]. Fig. 3-5 illustrate a time-lapse sequence of the US window during needle placement into the hip joint.

As demonstrated in Fig. 3, the needle was initially difficult to identify in both B-mode imaging and contrast-specific ultrasound modes. This occurred because contrast was not present within the needle lumen at that stage. Without microbubble contrast inside the needle, US detection relies largely on needle motion and favourable insonation angles, which can limit visibility, especially when accessing the hip joint [7]. Once the needle entered the joint space, the intra-articular cavity became markedly hyperechoic as shown in Fig. 4, as microbubble contrast enriched PRP dispersed within the joint. Subsequent imaging in Fig. 5 demonstrates improved visualisation of the needle shaft and tip due to the enhanced echogenicity of the joint space, with the contrast-enriched PRP outlining the characteristic saddle-shaped morphology of the hip joint, allowing confident confirmation of intra-articular needle placement and delivery of PRP.

The before-and-after contrast ultrasound images shown in Fig. 6 highlight the substantial improvement in needle localisation achieved with CEUS. Improved visualisation enhances procedural safety by allowing the operator to avoid adjacent neurovascular structures and ensures accurate intra-articular delivery, which is critical for treatment efficacy. Precise needle-tip localisation is particularly important during intra-articular PRP injections, as advancing too far may risk cartilage injury, while insufficient depth may result in extra-articular deposition and reduced therapeutic benefit [1,5,8].

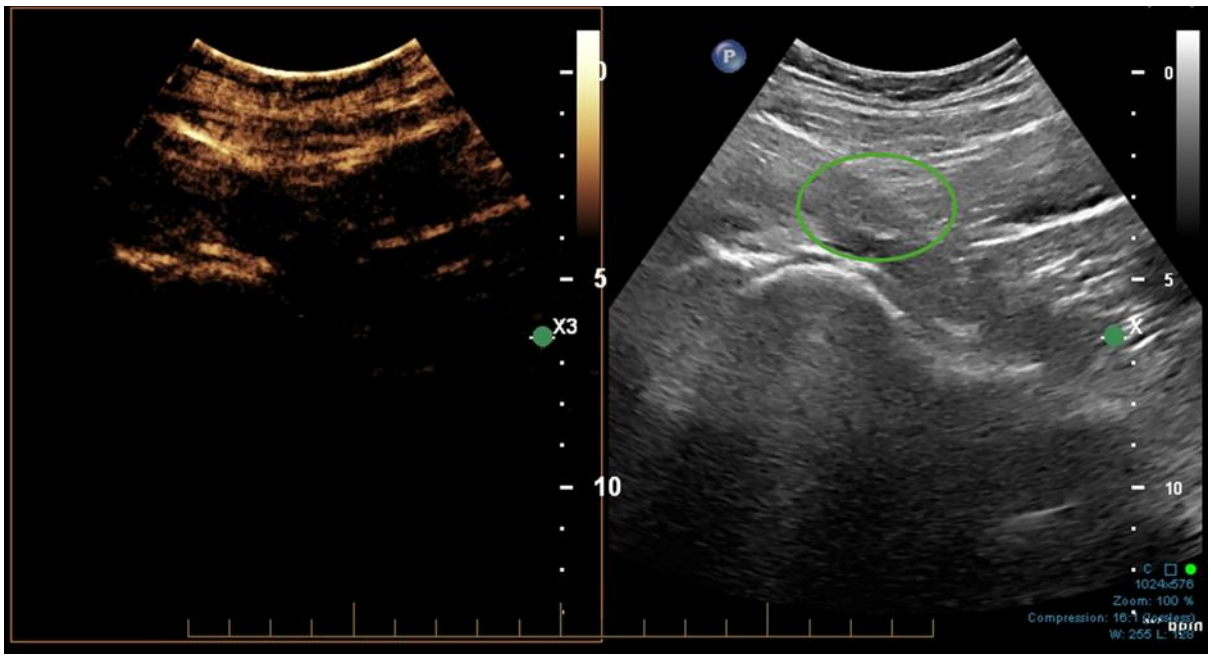

Figure 3: Contrast view (left) and US window (right) prior to insertion of needle head into the sub-capsular space. Circle showing subtle deformation of the surrounding soft tissues, indicating the needle's position approximately.

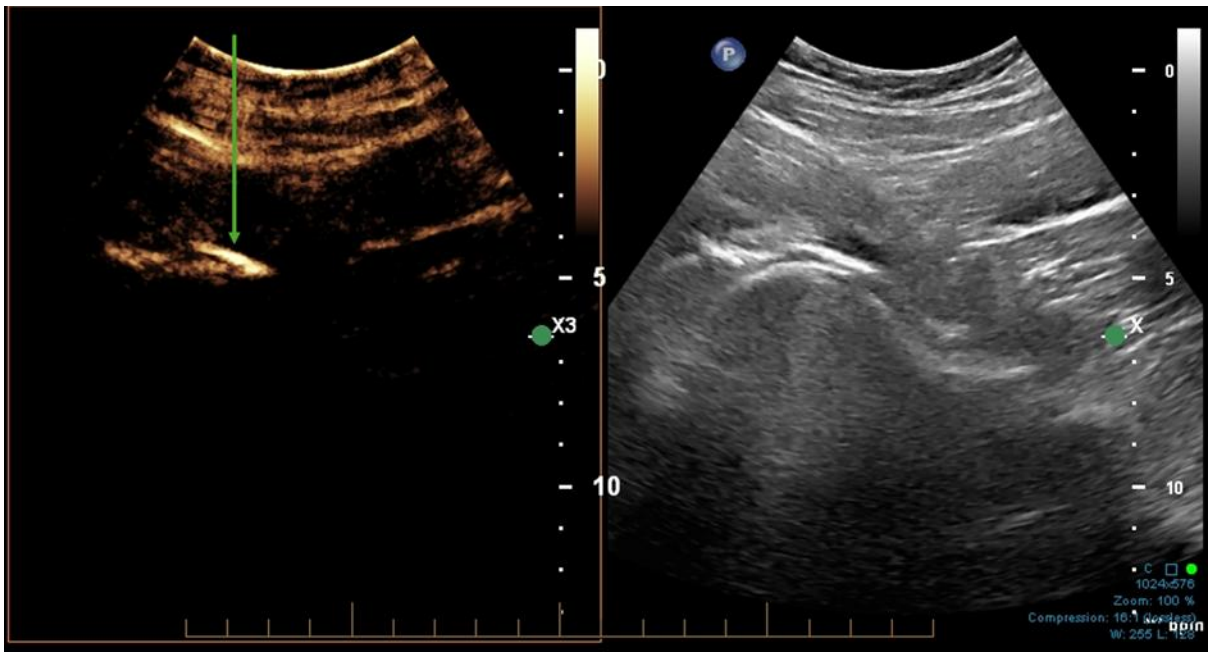

Figure 4: Contrast view (left) and US window (right) initially after insertion of needle head into the sub-capsular space. Arrow pointing at hyperechoic joint capsule.

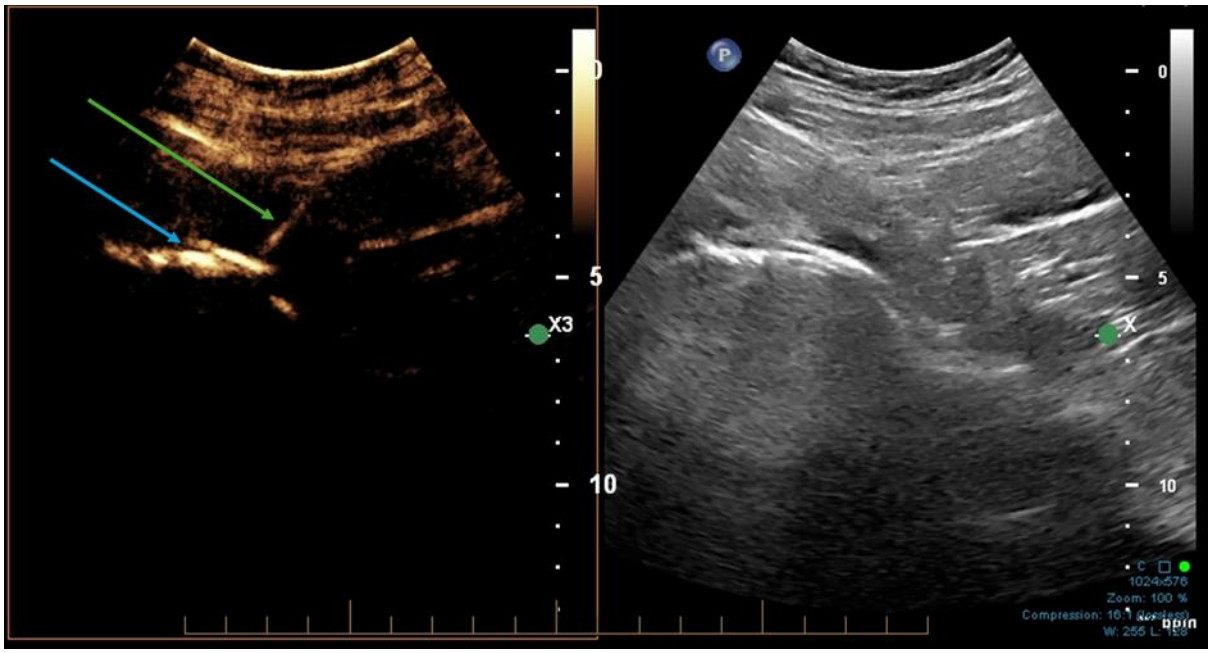

Figure 5: Contrast view (left) and US window (right) after insertion of needle head and retrograde movement of microbubble contrast PRP into the needle head. Green arrow pointing at now clearly visible needle and blue arrow pointing at further contrast enhancement of the joint space.

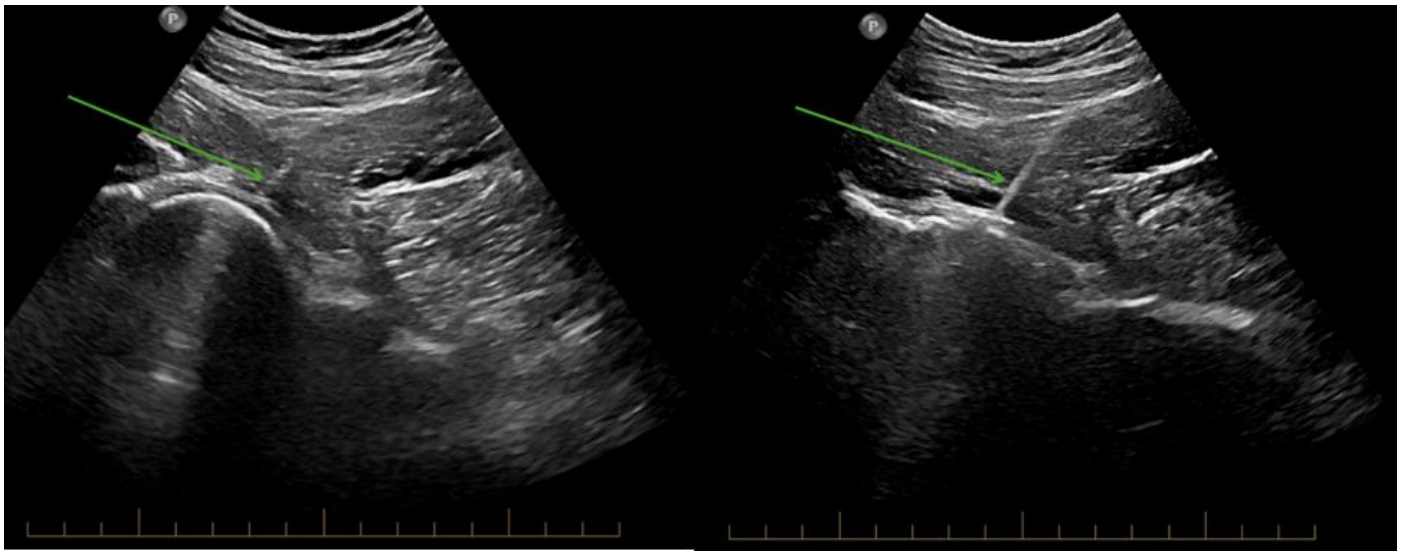

Figure 6: US window before (left) vs after (right) microbubble contrast PRP enhancement. Arrows are pointing to the needle, which is significantly more visible with contrast.

Conclusion

The technique described in this case demonstrates that contrast-enhanced US arthrography may improve the safety, and reduce the pain and discomfort of PRP delivery into the hip joint. Further refinements, such as priming the needle with contrast prior to skin entry, may allow continuous visualisation of the needle tip throughout advancement, further reducing procedural risk. There are, however, some limitations to CEUS, including the cost of the microbubble contrast agent itself, as well as specialised US equipment required for contrast-specific imaging. Overall, CEUS can generally be more cost effective than other imaging modalities used for PRP delivery such as fluoroscopy and CT due to their downstream costs.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Funding Statement
This research did not receive any specific grant from funding agencies in the public, commercial or non-profit sectors.

Acknowledgement
None.

Data Availability Statement
Not applicable.

Ethical Statement
The project did not meet the definition of human subject research under the purview of the IRB according to federal regulations and therefore was exempt.

Informed Consent Statement
Informed consent was taken for this study.

Authors' Contributions
All authors contributed equally to this paper.

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