American Journal of Case Reports

e-ISSN 1941-5923
© Am J Case Rep, 2026; 27: e952788
DOI: 10.12659/AJCR.952788

Received: 2025.01.13
Accepted: 2026.04.23
Available online: 2026.04.27
Published: 2026.XX.XX

# A 44-Year-Old Male Manual Laborer With Nonunion of a Femoral Neck Fracture Treated With Ultrasound-Guided Percutaneous Injections of Platelet-Rich Plasma: A Case Report

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABCDEF Zhi Qiu
B Yanyan Ma
AEG Hongju Liu

Department of Rehabilitation Medicine, Beijing Jishuitan Hospital Guizhou Hospital, Guiyang, Guizhou, PR China

**Corresponding Author:** Hongju Liu, e-mail: gzohrdliu@126.com
**Financial support:** The authors gratefully acknowledge the financial support for this research provided by the Key Advantageous Discipline Construction Project of Guizhou Provincial Health Commission (2025)
**Conflict of interest:** None declared



**Patient:** Male, 44-year-old
**Final Diagnosis:** Left greater trochanteric fracture • right femoral neck fracture nonunion • right femoral neck, intertrochanteric, and upper femoral shaft fractures
**Symptoms:** Hip pain • muscle weakness • range of motion limitation • walking difficulties
**Clinical Procedure:** PRP injections • ultrasonography
**Specialty:** Orthopedics and Traumatology • Rehabilitation

**Objective:** Unusual or unexpected effect of treatment

**Background:** Femoral neck fractures are prone to nonunion due to compromised vascular supply. While surgical revision remains the standard of care, biological approaches such as platelet-rich plasma (PRP), a concentrate rich in growth factors that enhance bone healing, offer a less invasive option. This report describes the case of a 44-year-old man, who worked as a manual laborer, with a femoral neck fracture nonunion who refused further surgery and was treated with ultrasound-guided percutaneous injections of PRP.

**Case Report:** Nine months after undergoing internal fixation for a complex hip fracture, a 44-year-old man presented with persistent right hip pain and gait impairment. Radiographic evaluation confirmed the diagnosis of an oligotrophic nonunion of the femoral neck. The patient declined surgical revision, and a nonsurgical biological intervention was pursued. This consisted of 3 ultrasound-guided percutaneous injections of autologous PRP administered at 1- to 2-week intervals, followed by a structured, phased rehabilitation protocol. Over the ensuing 7 months, serial radiographic follow-up demonstrated progressive bony union. The treatment resulted in complete resolution of pain at rest, minimal pain on weight-bearing, and a successful return to unassisted walking and light work. No adverse events were reported.

**Conclusions:** This case demonstrates that a series of ultrasound-guided percutaneous PRP injections can serve as a successful, minimally invasive, non-surgical alternative for promoting union in selected cases of femoral neck nonunion, potentially allowing patients to avoid revision surgery.

**Keywords:** Case Reports • Femoral Neck Fractures • Fracture Healing • Orthopedics • Platelet-Rich Plasma • Ultrasonography

**Full-text PDF:** https://www.amjcaserep.com/abstract/index/idArt/952788





Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]

## Introduction

Femoral neck fractures are common injuries with an incidence that increases with age, imposing a significant burden on orthopedic and trauma resources [1,2]. Achieving bone union in this region is notably more challenging than in many other long bones, primarily due to its unique and precarious vascular anatomy [3]. This compromised blood supply predisposes patients to high rates of complications, including avascular necrosis and nonunion of the femoral head [4]. Reported nonunion rates range from 10% to 59% in femoral neck fractures, and they may be observed more frequently in young patients as a result of high-energy trauma [5].

According to the standards established by the U.S. Food and Drug Administration (FDA), nonunion is typically diagnosed at 9 months after injury and is defined as a persistent fracture line without evidence of healing over 3 consecutive months [6,7]. Established management for femoral neck nonunion is predominantly surgical, involving revision fixation with bone grafting or arthroplasty [2]. In studies on the treatment of nonunions in the diaphysis of long bones, such as the tibia, femur, and humerus, as well as in the scaphoid, adjunctive measures are also combined with surgery, including platelet-rich plasma (PRP) and autologous bone marrow aspirate concentrate (BMAC), which enhance the osteogenic microenvironment through growth factor delivery and stem cell recruitment [8].

PRP is rich in key growth factors, such as platelet-derived growth factor, transforming growth factor-beta, vascular endothelial growth factor, and insulin-like growth factor-1 [9]. These cytokines regulate inflammation, angiogenesis, and osteoblastic activity, playing vital roles across the various phases of bone repair [9]. Evidence suggests that for specific nonunion types, such as oligotrophic nonunions of long bones, PRP can yield outcomes comparable to the surgical approach of solely exchanging intramedullary nailing [10]. However, a broader synthesis of evidence indicates that the efficacy of PRP monotherapy may be inferior to that of autologous cancellous bone grafting, which remains a biological gold standard [8]. Thus, PRP may be considered a less-invasive therapeutic option before proceeding to more extensive revision surgery.

While successful healing of femoral neck nonunion has been documented with BMAC [11] and bone cell therapy [12] in previous case reports, the use of PRP as a standalone, minimally invasive treatment for this condition represents an even less invasive alternative. This report describes the case of a 44-year-old man with nonunion of a femoral neck fracture who refused further surgery and was treated with ultrasound-guided percutaneous injections of PRP.

## Case Report

A 44-year-old Asian man who worked as a manual laborer presented 9 months after a fall with persistent right hip pain and impaired ambulation. He was strictly non–weight-bearing on the right side, requiring dual crutches. His pain was rated 2/10 on the visual analog scale at rest, increasing to 5/10 with attempted weight-bearing. The patient had no significant medical history, no family history of bone disorders, and was a nonsmoker with occasional alcohol consumption.

The initial injury (August 2024) resulted in complex right hip fractures (femoral neck, intertrochanteric region, and upper femoral shaft) and a fracture of the left greater trochanteric. He underwent closed reduction and internal fixation of the right hip with an intramedullary nail, a supplemental cannulated screw, and a constrained liner (**Figure 1A, 1B**). The left-sided injury was managed conservatively. The radiographic assessment of right hip fracture healing in this case was complicated by the presence of internal fixation hardware. The artifacts generated by the intramedullary nail and supplementary screws on plain radiographs obscured the fracture line at the femoral neck, making it challenging to definitively assess the presence or progression of bridging callus (**Figure 1A, 1B**). Therefore, computed tomography (CT) scans were used to assess the femoral neck fracture. Physical examination demonstrated limited right hip range of motion and decreased muscle strength. A CT scan confirmed a persistent fracture line in April 2025 (**Figure 2A**), leading to a diagnosis of oligotrophic nonunion according to the Weber-Cech classification system [3].

The diagnosis in this case was established as a nonunion 9 or more months after injury, with a persistent fracture line and no evidence of healing over 3 consecutive months, rather than a delayed union – a lack of healing 3 to 6 months after injury. This was confirmed by meeting the FDA time criterion and the absence of bridging callus on sequential imaging over the preceding 3 months [6,7]. Serial radiographic surveillance revealed no signs of hardware loosening, migration, or fracture gap widening, suggesting the absence of mechanical instability. Avascular necrosis was also ruled out, as CT images demonstrated preserved femoral head architecture without subchondral collapse, sclerosis, or cystic changes. Furthermore, the absence of periosteal reaction or bony erosion, coupled with consistently normal inflammatory markers, provided no support for an occult infectious process.

Given the patient's relative youth, strong preference to avoid further major surgery, and the confirmed oligotrophic (biologically deficient) nature of the nonunion, a nonsurgical biological approach was pursued. Under ultrasound guidance (**Figure 1C**), 5 mL of PRP (platelet concentration 500-1000×$10^9$/L) was injected percutaneously into the anterior aspect of the fracture





Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]

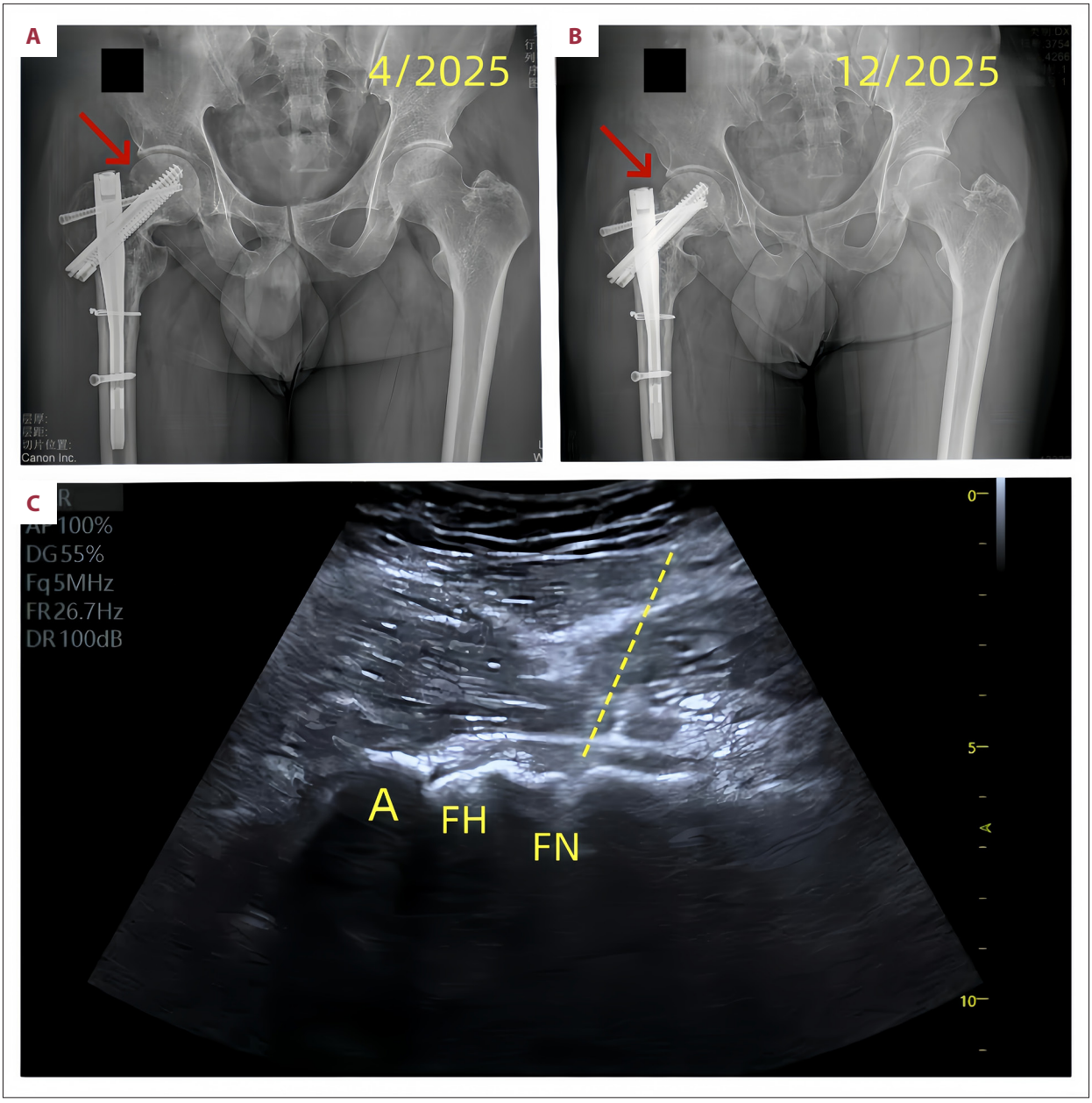


**Figure 1.** Imaging evaluation and guided intervention for femoral neck fracture nonunion. (**A**) An anteroposterior pelvic radiograph taken 9 months after injury shows internal fixation using an intramedullary nail, supplemented with a cannulated screw and a constrained liner for a complex right hip fracture, involving the femoral neck, intertrochanteric region, and proximal femoral shaft. A well-defined fracture line (red arrow) is visible at the femoral neck. (**B**) Follow-up radiograph (December 2025) demonstrates a blurred fracture line at the right femoral neck (red arrow). (**C**) Anterior hip ultrasound image (May 2025) illustrates the fracture line. The yellow dashed line indicates the planned needle trajectory.
Anatomical labels: A – acetabulum; FH – femoral head; FN – femoral neck.

site. The PRP was prepared using the Nigale PRP Preparation Kit (Single-Use Apheresis Blood Component Separator, Model P-2000 I U) and the Nigale Blood Component Separator (Model NGL XCF 3000). The first injection was administered on May 12, 2025, with the procedure repeated at 1- to 2-week intervals for a total of 3 sessions (**Figure 3**). No modifications to the treatment protocol were made during the course of therapy. The patient demonstrated excellent compliance with the treatment schedule and reported no significant discomfort during or after the injections. No adverse events, such as infection, hematoma, or nerve injury, were observed throughout the treatment and follow-up period.







Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]

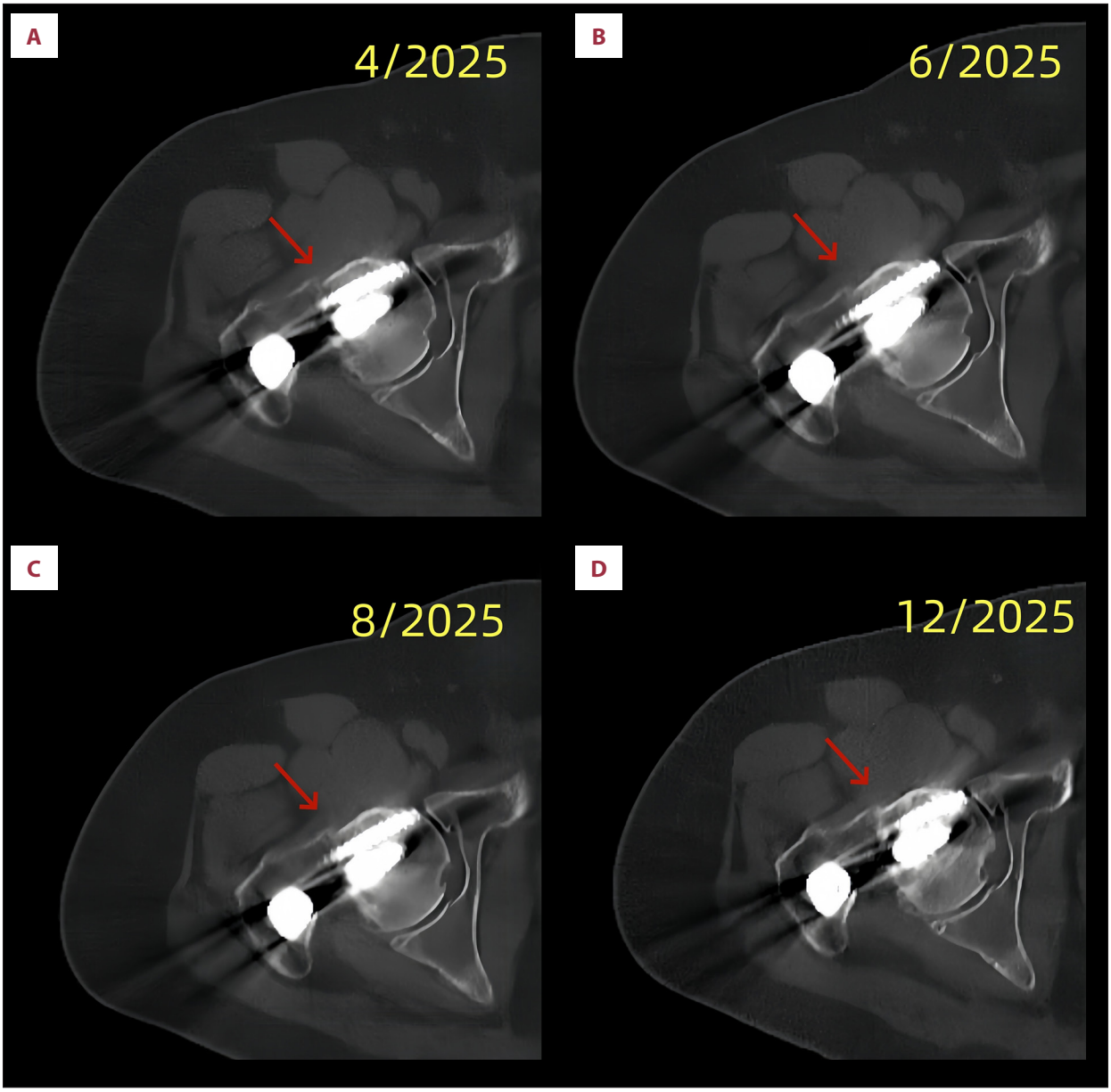


**Figure 2.** Sequential axial computed tomography (CT) evaluation of femoral neck fracture healing. (**A**) An axial CT image at the right femoral neck level in April 2025 reveals a distinct fracture line at the femoral head-neck junction (red arrow), consistent with a diagnosis of nonunion. (**B**) Follow-up CT scan in June 2025, 7 weeks after the initial injection, shows partial blurring of the fracture line (red arrow). (**C**) Follow-up CT scan in August 2025 demonstrates further obscuration of the fracture line (red arrow). (**D**) Follow-up CT scan in December 2025 indicates near-complete resolution of the fracture line (red arrow), suggesting progressive healing of the femoral neck fracture.

Post-procedural rehabilitation followed a phased protocol. The initial phase (weeks 1-8) focused on active and active-assisted non–weight-bearing hip range-of-motion exercises. Weeks 8 to 12 introduced progressive partial weight-bearing as tolerated. From week 13 onward, full weight-bearing was gradually achieved. A follow-up CT scan performed 7 weeks after the initial injection (June 30, 2025) revealed early signs of healing, which continued to improve progressively over the subsequent 6 months (**Figure 2**). Ultimately, the patient's hip pain resolved completely at rest (visual analog scale 0/10) and decreased to 2/10 during full weight-bearing. He successfully resumed unassisted walking and returned to daily activities and light work. The patient expressed satisfaction with the nonsurgical approach and reported significant improvement in quality of life.





Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]

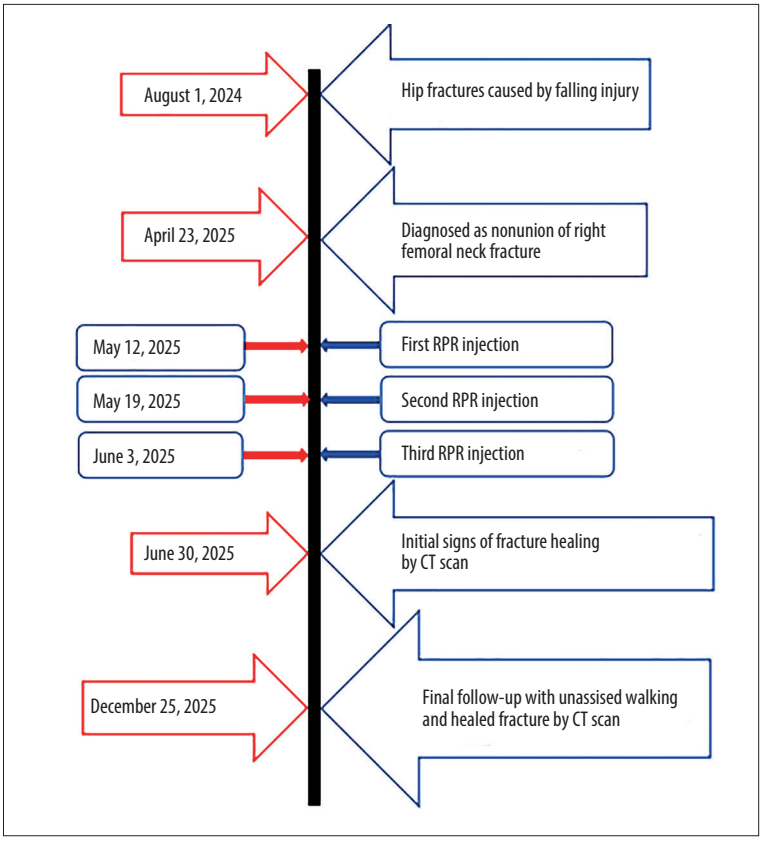


**Figure 3.** Timeline of diagnoses and interventions. CT – computed tomography; PRP – platelet-rich plasma.

## Discussion

This case illustrates that a series of ultrasound-guided percutaneous PRP injections promoted healing of an established femoral neck nonunion in a young, active patient, resulting in radiographic union, complete resolution of pain at rest, restoration of functional ambulation, and a high level of patient satisfaction. The outcome highlights a viable nonsurgical approach that successfully circumvented the need for revision surgery.

The 44-year-old man who worked as a manual laborer sustained complex high-energy fractures of the femoral neck, intertrochanteric region, and upper femoral shaft. This injury pattern aligns with the epidemiology of combined femoral neck and shaft fractures, typically seen in younger men after high-energy trauma [13]. Its healing timeline [13] exceeds the average of 14 weeks reported for isolated femoral neck fractures [14] or those with intertrochanteric fractures [15]. The decision to attempt PRP in this case was guided by a patient-centered approach. Key factors included the patient's strong aversion to further surgery, young age, good systemic health, and the radiographically confirmed oligotrophic nature of the nonunion in the absence of contraindications, such as fracture instability, avascular necrosis, or occult infection. PRP was chosen over other biologics due to its minimally invasive preparation and excellent safety profile.

Following ultrasound-guided PRP injections, the patient's femoral neck nonunion demonstrated progressive healing, with initial signs of union observed on CT imaging 7 weeks after the first injection. This successful outcome may be attributed to a targeted biological intervention addressing the underlying pathophysiology of an oligotrophic nonunion, rather than an atrophic nonunion. According to the literature, atrophic nonunion is characterized by a complete absence of periosteal callus, typically due to impaired vascularity at the fracture site [6]. In contrast, oligotrophic nonunion presents with limited periosteal callus formation and is thought to involve relatively preserved vascularity but significantly reduced osteogenic potential [6]. It is often associated with moderate resorption of bone ends, which can result from instability, malreduction with diastasis, or poor local biology [16]. The more severe atrophic nonunion is defined by the absence of viable bone ends in contact and represents a state of bone defect with no intrinsic healing capacity [16].

In our case, the ultrasound-guided delivery of a high concentration of growth factors from PRP directly to the fracture site was hypothesized to stimulate key regenerative processes, including angiogenesis and osteoblast recruitment [9], thereby reactivating the stalled healing cascade characteristic of oligotrophic nonunion. This contrasts with the method reported by Modest et al [11] in a 29-year-old man with an atrophic femoral







Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]

neck nonunion, whose treatment involved percutaneous screw removal, tract debridement, and BMAC injection directly into the nonunion site and intra-articularly. In a separate report by Mehra et al [12], a 56-year-old woman with an atrophic femoral neck nonunion was treated with a 2-stage cell therapy involving a 4-week ex vivo culture of bone marrow aspirate followed by surgical implantation of osteogenic cells, leading to union by 10 weeks. Unlike the approach used by Modest et al [11], the cell therapy by Mehra et al [12], like our PRP intervention, did not require hardware removal. However, it introduced a 4-week preparatory delay for cell culture, whereas both the BMAC injection used by Modest et al [11] and our PRP treatment allowed immediate biologic application.

The current literature on PRP for femoral neck fractures primarily focuses on its intraoperative application during initial fixation, where it has been shown to accelerate healing [17]. Most studies on PRP for nonunion involve long bone diaphyses [18], a site with a markedly different biological environment and healing potential compared with the poorly vascularized femoral neck. The existing evidence regarding PRP for the adjuvant treatment of fracture nonunion and delayed union presents a complex and somewhat contradictory profile [9]. The therapeutic efficacy of PRP appears to be contingent on its application modality. While a network meta-analysis suggests that the combination of BMAC and PRP may confer a relative advantage in improving the radiographic healing rate [8], a subsequent umbrella review analyzing pooled data from individual studies found that PRP monotherapy did not significantly increase union rates compared with controls [19]. More consistent evidence supports a beneficial effect of PRP on reducing the time to union [19]. Regarding safety, PRP demonstrates a favorable profile, as it is not associated with a significant increase in the risk of adverse events [19], in contrast to other physical modalities, such as electromagnetic field or extracorporeal shockwave therapy, which showed higher adverse event risks [8]. However, clinical adoption remains limited by significant methodological heterogeneity in preparation and application protocols [9], and the current clinical evidence, graded as low to moderate [19], does not yet support its routine use.

The conclusions drawn from this single case report are inherently limited. The patient's relatively young age and good general health may have contributed to the favorable outcome, limiting generalizability to older patients and those with comorbidities. The follow-up period of 7 months may be insufficient to assess long-term outcomes, particularly the risk of avascular necrosis, and the absence of a control group precludes definitive efficacy claims. These limitations highlight the need for rigorous future research, including prospective controlled studies and randomized trials comparing percutaneous PRP with standard surgery, as well as long-term cohort studies to monitor the durability of healing and the risk of late avascular necrosis. Standardization of PRP protocols will be crucial for generating conclusive data.

## Conclusions

This case report demonstrates the successful use of ultrasound-guided PRP injection as a stand-alone biological treatment for an established femoral neck nonunion. The approach may be most suitable for young, healthy patients with oligotrophic nonunions, in which mechanical stability is already achieved. While the outcome is promising, larger, controlled studies with extended follow-up are necessary to confirm efficacy, establish robust patient selection criteria, and define the precise role of this minimally invasive approach within the broader treatment algorithm for femoral neck nonunion.

### Acknowledgments

The authors thank the staff of the Blood Transfusion Department at Beijing Jishuitan Hospital Guizhou Hospital for their support in preparing the PRP. We also gratefully acknowledge Professor Li Jiang and Dr Zhipeng Li from the Department of Rehabilitation Medicine, the Third Affiliated Hospital of Southern Medical University, for their guidance on the ultrasound technique. Additionally, we extend our thanks to Tencent's Yuanbao AI assistant for its assistance in language polishing, translation, and grammar checking during the preparation of our manuscript.

### Department and Institution Where Work Was Done

This study was performed at the Rehabilitation Medicine Department, Beijing Jishuitan Hospital Guizhou Hospital, Guiyang, Guizhou, PR China.

### Patient Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

### Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.





Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]

## References:

1. Borgström F, Karlsson L, Ortsäter G, et al; International Osteoporosis Foundation. Fragility fractures in Europe: Burden, management and opportunities. Arch Osteoporos. 2020;15(1):59
2. Randelli F, Viganò M, Liccardi A, et al. Femoral neck fractures: Key points to consider for fixation or replacement a narrative review of recent literature. Injury. 2023;54(Suppl. 1):S70-S77
3. Panteli M, Rodham P, Giannoudis PV. Biomechanical rationale for implant choices in femoral neck fracture fixation in the non-elderly. Injury. 2015;46(3):445-52
4. Kurahashi S, Takegami Y, Tokutake K, et al. Risk factors for nonunion in femoral neck fracture patients with internal fixation: A multicenter (TRON group) retrospective study. J Orthop Sci. 2025;30(4):672-77
5. Schwartsmann CR, Spinelli Lde F, Yépez AK, et al. Femoral neck nonunion treatment by valgus intertrochanteric osteotomy. Acta Ortop Bras. 2015;23(6):319-22
6. Bowers KM, Anderson DE. Delayed union and nonunion: Current concepts, prevention, and correction: A review. Bioengineering (Basel). 2024;11(6):525
7. Rupp M, Kern S, El Khassawna T, et al. Do systemic factors influence the fate of nonunions to become atrophic? A retrospective analysis of 162 cases. Biomed Res Int. 2019;2019:6407098
8. Yang J, Zhang X, Liang W, et al. Efficacy of adjuvant treatment for fracture nonunion/delayed union: A network meta-analysis of randomized controlled trials. BMC Musculoskelet Disord. 2022;23(1):481
9. Bacevich BM, Smith RDJ, Reihl AM, et al. Advances with platelet-rich plasma for bone healing. Biologics. 2024;18:29-59
10. Duramaz A, Ursavaş HT, Bilgili MG, et al. Platelet-rich plasma versus exchange intramedullary nailing in treatment of long bone oligotrophic nonunions. Eur J Orthop Surg Traumatol. 2018;28(1):131-37
11. Modest JM, Lemme NJ, Testa EJ, et al. Successful fracture healing for femoral neck nonunion with bone marrow aspirate concentrate. R I Med J (2013). 2022;105(2):13-16
12. Mehra A. Treatment of femoral neck non-union using bone cell therapy: A case report. J Orthop Case Rep. 2021;11(8):20-23
13. Mohan K, Ellanti P, French H, et al. Single versus separate implant fixation for concomitant ipsilateral femoral neck and shaft fractures: A systematic review. Orthop Rev (Pavia). 2019;11(2):7963
14. He C, Lu Y, Wang Q, et al. Comparison of the clinical efficacy of a femoral neck system versus cannulated screws in the treatment of femoral neck fracture in young adults. BMC Musculoskelet Disord. 2021;22(1):994
15. Kim HS, Lee DK, Mun KU, et al. What is the best treatment choice for concomitant ipsilateral femoral neck and intertrochanteric fracture? A retrospective comparative analysis of 115 consecutive patients. J Pers Med. 2022;12(11):1908
16. Solomin LN, Semenistyy AA, Komarov AV, et al. Universal long bone nonunion classification. Strategies Trauma Limb Reconstr. 2023;18(3):169-73
17. Samy AM. The role of platelet rich plasma in management of fracture neck femur: New insights. Int Orthop. 2016;40(5):1019-24
18. Li S, Xing F, Luo R, Liu M. Clinical effectiveness of platelet-rich plasma for long-bone delayed union and nonunion: A systematic review and meta-analysis. Front Med (Lausanne). 2022;8:771252
19. Zhu J, Han D, Sun Y, Zhao C. Platelet-rich plasma in the treatment of delayed union and nonunion fractures: An umbrella meta-analysis. J Orthop Sci. 2025;30(5):894-904







Indexed in: [PMC] [PubMed] [Emerging Sources Citation Index (ESCI)] [Web of Science by Clarivate]