EAS Journal of Orthopaedic and Physiotherapy
Abbreviated Key Title: EAS J Orthop Physiother
ISSN 2663-0974 (Print) | ISSN 2663-8320 (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-7 | Issue-4 | Jul-Aug, 2025 | DOI: https://doi.org/10.36349/easjop.2025.v07i04.005

Case Report

Modified Triple-Bundle Tension Band Wiring for Comminuted Patella Fractures: A Case Report

Dr. T. Siddhu Tamil Chellam[1*], Dr. Abhishek Jain[2]

[1]JR Dept of orthopaedics, Sri Balaji Medical College and Hospital, Chrompet, Chennai, India
[2]Radiologist Sri Balaji Medical College and Hospital, Chrompet, Chennai, India

Article History
Received: 12.05.2025
Accepted: 16.07.2025
Published: 19.07.2025

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: Patellar fractures, which compromise the knee's extensor mechanism, are commonly encountered orthopedic injuries. Tension band wiring (TBW) is the standard approach for managing simple transverse fractures but is not without complications such as wire migration and breakage. This case report introduces a modified TBW method intended to enhance mechanical stability and mitigate common hardware-related issues. A 51-year-old woman presented with right knee pain and swelling after a fall. Radiographs showed a transverse patellar fracture. She underwent surgical fixation using a triple-bundle wire technique designed to boost construct integrity and prevent wire migration. Postoperative management involved early mobilization with continuous passive motion and gradual progression to full weight-bearing. At a three-month follow-up, the patient exhibited complete fracture healing and excellent knee function, with no implant-related issues. This modified TBW approach proved to be biomechanically stable, safe, and conducive to early recovery, warranting consideration for wider clinical application.

Keywords: Patellar fractures, Tension band wiring (TBW), Comminuted fractures, Knee extensor mechanism, Surgical fixation, Wire migration.

INTRODUCTION

The patella, the body's largest sesamoid bone, plays a vital role in knee extension. Patellar fractures account for approximately 1% of adult skeletal injuries and typically result from either direct trauma or forceful contraction of the quadriceps muscle [1]. These fractures often impair the extensor mechanism, necessitating surgical intervention to restore patellar alignment and knee extension [2, 3].

Comminuted fractures (AO/OTA type 34-C3) are particularly challenging due to the presence of multiple fragments and disrupted soft tissue attachments. The AO Surgery Reference recommends cerclage compression wiring for such fractures to achieve circumferential stability [4]. However, this method is frequently associated with soft tissue irritation and hardware discomfort. While TBW is the preferred method for simple fractures, its application in comminuted patterns is limited by biomechanical instability and a higher risk of fixation failure [5].

This report presents a modified TBW method tailored to comminuted patellar fractures, aiming to improve fixation strength, minimize complications, and promote better clinical outcomes in complex cases.

CASE PRESENTATION

A 47-year-old female presented with acute pain, swelling, and inability to bear weight on her right knee following a fall down stairs, during which she struck her flexed knee. On examination, there was visible swelling, a palpable defect over the patella, and loss of active knee extension—indicative of extensor mechanism injury. X-rays confirmed a comminuted patellar fracture (AO/OTA 34-C3) with multiple displaced fragments (Figure 1).

***Corresponding Author:** Dr. T. Siddhu Tamil Chellam
JR Dept of orthopaedics, Sri Balaji Medical College and Hospital, Chrompet, Chennai, India

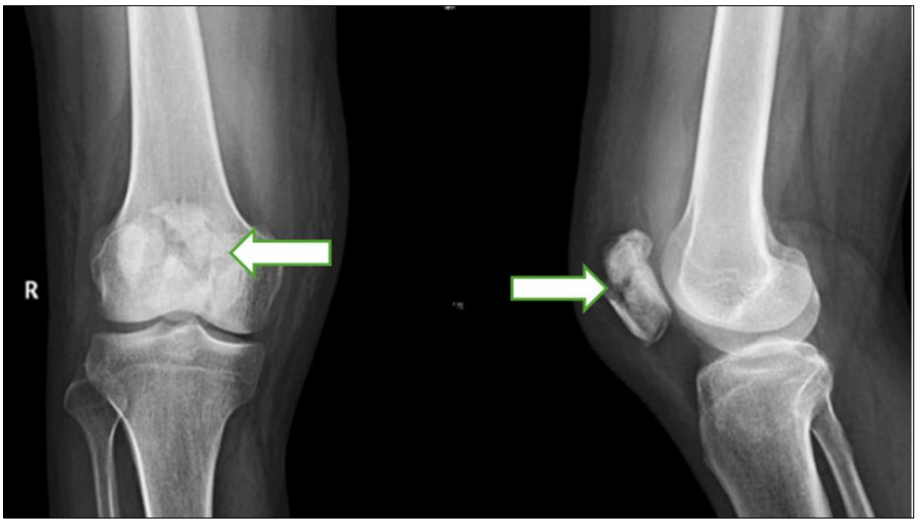

Figure 1: Preoperative radiograph (anteroposterior and lateral views) showing comminuted patella fracture (AO/OTA 34-C3) with multiple displaced fragments

The patient was taken for surgery under spinal anesthesia. A midline anterior incision was made to expose the patella. Hematoma was evacuated and fracture fragments visualized. Using pointed reduction forceps, anatomic reduction was achieved under direct vision.

Surgical Technique

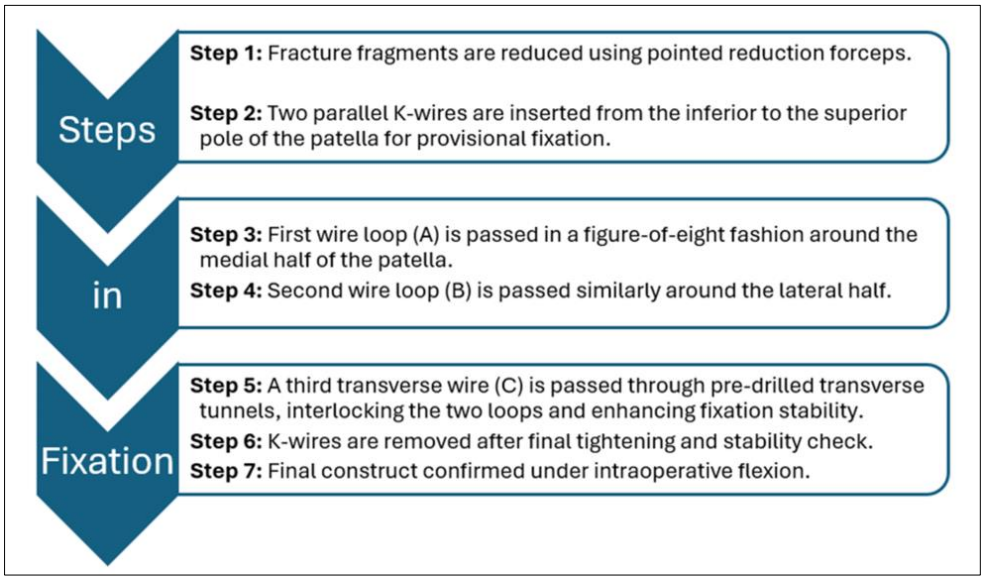

Figure 2: Surgical Steps for the Modified Tension Band Wiring Technique

Two longitudinal 1.6 mm K-wires were initially inserted from the inferior to the superior pole to temporarily hold the reduction. The fixation construct included three stainless steel wires (1.5 mm each): two were placed in a figure-of-eight fashion around each half of the patella, and a third transverse wire was passed through pre-drilled holes to interlock with the others, thereby increasing overall stability. After confirming secure fixation through 90° of knee flexion, the K-wires were removed. The retinaculum was sutured, and layered closure was performed (Figure 3).

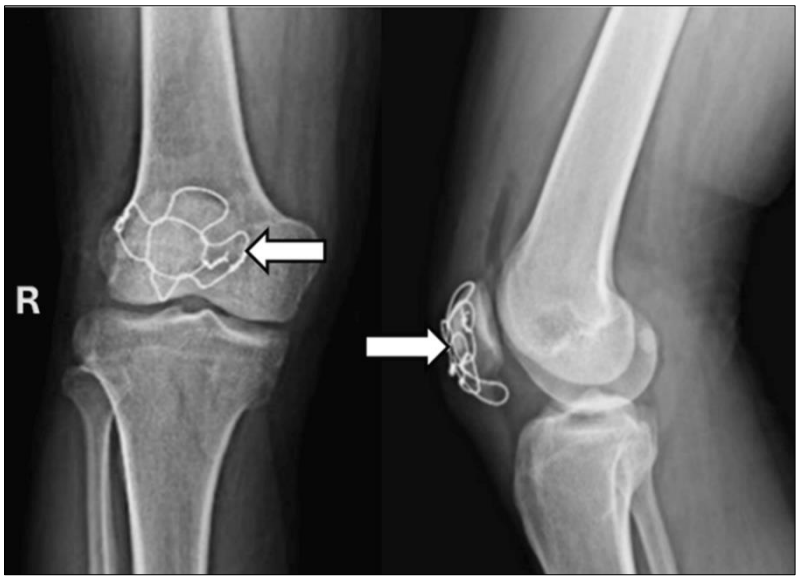

Figure 3: Postoperative radiograph showing patella fixation with the modified triple fixation technique

Postoperatively, the knee was immobilized in extension with a brace. Continuous passive motion and quadriceps strengthening exercises began on postoperative day one. Partial weight-bearing was allowed for four weeks, followed by progressive full weight-bearing. At three months, radiographs showed complete fracture healing (Figure 4), and the patient had full, pain-free range of motion with independent walking ability.

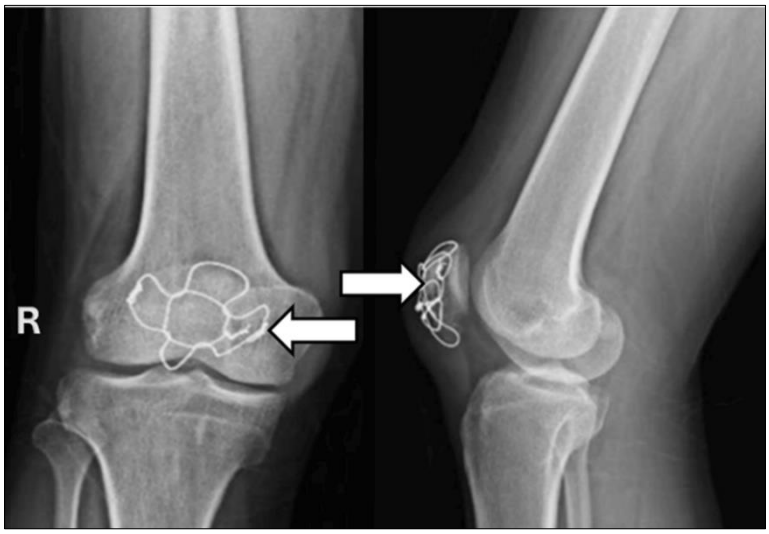

Figure 4: Radiograph (anteroposterior and lateral views) at three months showing union

DISCUSSION

Although TBW is a popular method for treating patellar fractures, it frequently leads to complications such as wire migration, breakage, and patient discomfort due to hardware prominence [6, 7]. Alternatives like cerclage wiring and plating have been introduced, but these are more invasive, expensive, and require extensive dissection [8, 9].

In this case, a triple-bundle TBW approach was used, offering increased construct strength and redundancy. If one wire fails, the others maintain fixation. Placing the wires close to the bone and beneath the retinaculum helps reduce the risk of migration or irritation. This allowed early mobilization—a critical factor in preserving knee motion and expediting recovery.

Cerclage wiring, as advised by the AO Surgery Reference for AO/OTA 34-C3 fractures, ensures fragment compression circumferentially. However, its limitations include difficulty securing small or irregular fragments and potential loosening, especially in osteoporotic bone. Our method, by creating medial and lateral figure-of-eight loops and reinforcing with a transverse wire, allows for targeted and multidirectional stabilization. This segmented approach increases

reliability, avoids bulky implants, and simplifies the procedure—making it advantageous in both high- and low-resource environments.

Although this is a single case, the technique showed promising radiological and functional results. Larger clinical series and biomechanical studies are required to validate these findings and assess the long-term performance of this method.

CONCLUSIONS

The modified triple-bundle TBW technique proved to be a secure fixation method for a complex patellar fracture (AO/OTA 34-C3), allowing early rehabilitation and excellent functional results without any hardware-related issues. This technique offers several benefits over traditional TBW, including enhanced wire stability, reduced risk of migration, and a less prominent implant profile. Due to its simplicity, cost-effectiveness, and clinical performance, it may serve as a valuable alternative for managing complex patellar fractures, especially in settings with limited resources. Further research is warranted to assess its broader applicability and long-term outcomes.

REFERENCES

1. Rajani AM, Dubey R, Kulkarni V, Desouza C, Mittal AR: Novel technique for fracture fixation of the patella following unicondylar knee replacement: a clinical case report. J Orthop Case Rep. 2025, 15:197-201. 10.13107/jocr.2025.v15.i01.5176
2. Scolaro J, Bernstein J, Ahn J: Patellar fractures. Clin Orthop Relat Res. 2011, 469:1213-5. 10.1007/s11999-010-1537-8
3. Kakazu R, Archdeacon MT: Surgical management of patellar fractures. Orthop Clin North Am. 2016, 47:77-83. 10.1016/j.ocl.2015.08.010
4. AO Surgery Reference. Cerclage compression suture. (2025). Accessed: April 10, 2025: https://surgeryreference.aofoundation.org/orthopedic-trauma/adult-trauma/patella/complete-articular-frontal-coronal-m....
5. Hoshino CM, Tran W, Tiberi JV, Black MH, Li BH, Gold SM, Navarro RA: Complications following tension-band fixation of patellar fractures with cannulated screws compared with Kirschner wires. J Bone Joint Surg Am. 2013, 95:653-9. 10.2106/JBJS.K.01549
6. Zhu XZ, Huang TL, Zhu HY, et al.: A retrospective cohort study on prevalence of postoperative complications in comminuted patellar fractures: comparisons among stabilized with Cannulated-Screw, Kirschner-Wire, or Ring-Pin Tension Bands. BMC Musculoskelet Disord. 2021, 22:60. 10.1186/s12891-020-03936-5
7. Hsu KL, Chang WL, Yang CY, Yeh ML, Chang CW: Factors affecting the outcomes of modified tension band wiring techniques in transverse patellar fractures. Injury. 2017, 48:2800-6. 10.1016/j.injury.2017.10.016
8. Tarabichi M, Mungalpara N, Lichtig A, Kim S, Karam J, Koh J, Amirouche F: Anterior variable angle locking neutralisation plate superiority over traditional tension band wiring for treating transverse patella fractures. J Exp Orthop. 2024, 11:e12088. 10.1002/jeo2.12088
9. Bel JC, Lefèvre C: Reconstruction of patella fractures with the tension band technique: A review on clinical results and tips and tricks. Injury. 2024, 55 Suppl 1:111401. 10.1016/j.injury.2024.111401

Citation: T. Siddhu Tamil Chellam & Abhishek Jain (2025). Modified Triple-Bundle Tension Band Wiring for Comminuted Patella Fractures: A Case Report. *EAS J Orthop Physiother, 7*(4): 70-73.