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-8 | Issue-3 | May-Jun, 2026 | DOI: https://doi.org/10.36349/easjop.2026.v08i03.002

Case Report

Comprehensive Review of Plate Fixation in Periprosthetic Femoral Fractures after Total Hip Arthroplasty: A Series of 5 Cases

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Article History
Received: 11.04.2026
Accepted: 01.06.2026
Published: 03.06.2026

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

Quick Response Code

Abstract: Periprosthetic femoral fractures following total hip arthroplasty (THA) are increasingly encountered in orthopedic practice due to the growing number of arthroplasties performed worldwide and the aging population. These fractures are associated with substantial morbidity and require complex surgical management. Locking plate fixation has become a cornerstone in the treatment of fractures with stable femoral stems. This study presents a detailed retrospective analysis of five cases treated at CHU Rabat using locking compression plates with or without cerclage wiring. Clinical presentation, radiological findings, surgical techniques, postoperative rehabilitation, and outcomes are discussed in detail.

Keywords: Periprosthetic femoral fracture, Total hip arthroplasty (THA), Locking compression plate (LCP), Locking plate fixation, Cerclage wiring.

INTRODUCTION

Periprosthetic femoral fractures are among the most severe complications after total hip arthroplasty. Their incidence ranges from 0.1% to 4% after primary THA and increases significantly after revision arthroplasty. Improvements in implant survival and increased life expectancy have resulted in a growing number of elderly patients exposed to these complications.

The management of these fractures is particularly difficult because surgeons must simultaneously address fracture healing, implant stability, and restoration of limb function. In elderly osteoporotic patients, stable fixation is technically demanding and postoperative rehabilitation can be prolonged.

The Vancouver classification system introduced by Duncan and Masri remains the gold standard for treatment planning. Vancouver B1 fractures, characterized by a stable stem and adequate bone stock, are ideally managed using locking plate fixation. Modern polyaxial locking systems and cable fixation techniques have significantly improved mechanical stability and union rates.

The purpose of this study is to provide a detailed analysis of plate fixation in periprosthetic femoral fractures after THA and to evaluate the clinical and radiological outcomes in a series of five patients.

Anatomy and Biomechanics

The proximal femur is exposed to major biomechanical stresses during gait and weight-bearing activities. Total hip arthroplasty alters normal load transmission through the femur, producing stress shielding and cortical bone remodeling.

Biomechanical factors contributing to periprosthetic fractures include:

- Osteoporosis and cortical thinning
- Stress concentration at the stem tip
- Femoral stem malalignment
- Repeated microtrauma
- Loosening of the implant

The periosteal blood supply plays a critical role in fracture healing. Excessive periosteal stripping during surgery may compromise healing and increase the risk of nonunion.

The use of long locking plates distributes mechanical stress over a larger area and decreases the risk of implant failure.

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Vancouver Classification

The Vancouver classification is based on:

- Fracture location
- Stability of the femoral stem
- Quality of surrounding bone stock

Type A: fractures involve the trochanteric region.
Type B: fractures occur around or just below the stem.
Type C: fractures are located well distal to the implant.
Subtype B1: fractures are characterized by a stable stem and are generally treated by internal fixation.
Subtype B2: fractures involve stem loosening and usually require revision arthroplasty.
Subtype B3: fractures are associated with severe bone loss and represent the most difficult therapeutic challenge.

Patients and Methods

We performed a retrospective descriptive study including five patients treated between 2021 and 2025 at the Department of Trauma and Orthopedic Surgery of CHU Rabat.

Inclusion Criteria:

- Periprosthetic femoral fractures after THA
- Treatment using locking plate fixation
- Minimum follow-up of six months

Exclusion Criteria:

- Fractures treated by stem revision
- Tumoral fractures
- Incomplete records

Parameters Analyzed:

- Age and gender
- Mechanism of injury
- Fracture classification
- Surgical approach
- Implant type
- Time to union
- Postoperative complications
- Functional recovery

All patients underwent radiological assessment using anteroposterior and lateral radiographs. CT scan was performed in selected cases to evaluate stem stability and fracture extension.

Surgical Technique

Patients were operated under general or spinal anesthesia in lateral decubitus position.

A direct lateral femoral approach was used in all patients. Great care was taken to preserve soft tissue attachments and periosteal vascularization.

Fracture reduction was obtained using reduction clamps and temporary cerclage wires when necessary.

Fluoroscopic guidance was used throughout the procedure.

Fixation Principles Included:

- Long bridging locking plates
- Bicortical distal fixation
- Proximal unicortical or polyaxial screws
- Cerclage cables around the proximal fragment

The plate length was chosen to span the entire femur whenever possible in order to reduce stress concentration and prevent secondary fractures.

Postoperative Rehabilitation

Early mobilization was encouraged beginning on postoperative day two. Rehabilitation included:

- Passive range-of-motion exercises
- Quadriceps strengthening
- Thromboembolic prophylaxis
- Respiratory physiotherapy in elderly patients

Protected partial weight-bearing was generally maintained for six to eight weeks depending on fracture stability and radiographic progression.

Clinical and radiological follow-up was performed at 6 weeks, 3 months, 6 months, and 1 year.

Radiological Illustrations

Figure 1: Preoperative and postoperative radiographs showing a Vancouver B1 periprosthetic femoral fracture around a stable femoral stem treated using a long locking plate and proximal cerclage cables.

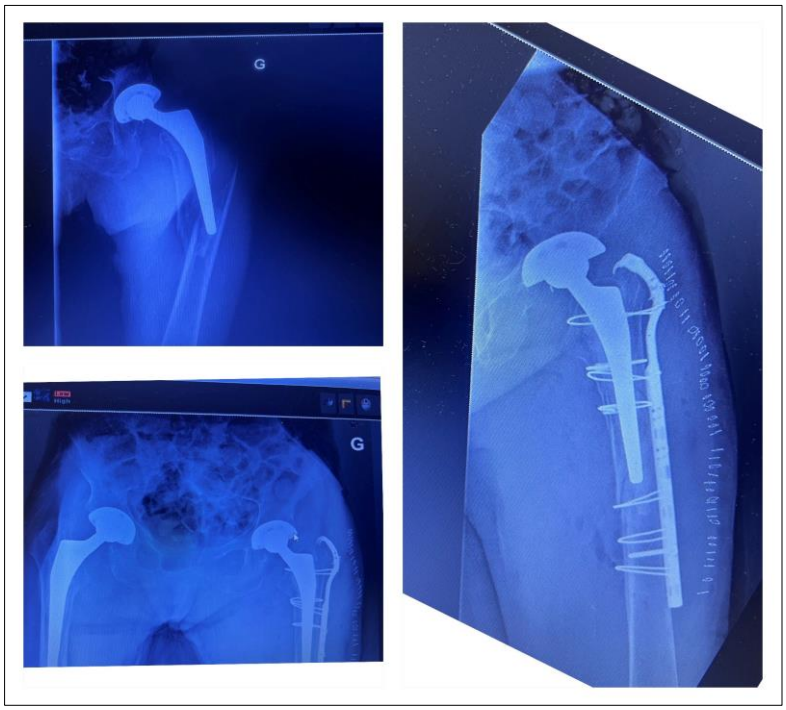

Figure 2: Spiral periprosthetic femoral fracture after total hip arthroplasty. Postoperative control demonstrates satisfactory reduction and stable fixation

CASE REPORTS

Case 1

This patient presented with a periprosthetic femoral fracture after total hip arthroplasty. Clinical examination revealed pain, deformity, and inability to bear weight. Radiographs confirmed a Vancouver type B1 fracture. Surgical fixation using a locking compression plate was performed successfully.

Postoperative rehabilitation was initiated early with progressive recovery.

Case 2

This patient presented with a periprosthetic femoral fracture after total hip arthroplasty. Clinical examination revealed pain, deformity, and inability to bear weight. Radiographs confirmed a Vancouver type B1 fracture. Surgical fixation using a locking compression plate was performed successfully. Postoperative rehabilitation was initiated early with progressive recovery.

Case 3

This patient presented with a periprosthetic femoral fracture after total hip arthroplasty. Clinical examination revealed pain, deformity, and inability to bear weight. Radiographs confirmed a Vancouver type C fracture. Surgical fixation using a locking compression plate was performed successfully. Postoperative rehabilitation was initiated early with progressive recovery.

Case 4

This patient presented with a periprosthetic femoral fracture after total hip arthroplasty. Clinical examination revealed pain, deformity, and inability to bear weight. Radiographs confirmed a Vancouver type B1 fracture. Surgical fixation using a locking compression plate was performed successfully. Postoperative rehabilitation was initiated early with progressive recovery.

Case 5

This patient presented with a periprosthetic femoral fracture after total hip arthroplasty. Clinical examination revealed pain, deformity, and inability to bear weight. Radiographs confirmed a Vancouver type B1 fracture. Surgical fixation using a locking compression plate was performed successfully. Postoperative rehabilitation was initiated early with progressive recovery.

DISCUSSION

The treatment of periprosthetic femoral fractures remains controversial and technically demanding. Several fixation strategies have been proposed, including conventional plates, cable systems, revision stems, and locking compression plates.

Locking plates provide several biomechanical advantages:

- Angular stability
- Improved fixation in osteoporotic bone
- Better resistance to torsional forces
- Reduced risk of screw pull-out

Modern polyaxial locking systems facilitate screw insertion around the femoral stem and improve fixation in difficult anatomical regions.

Cerclage cables improve proximal fixation but excessive use may impair periosteal blood supply. Therefore, careful application is essential.

Several studies report union rates exceeding 85–90% with locking plate fixation. Common complications include:

- Delayed union
- Nonunion
- Infection
- Implant failure
- Stem loosening

In our study, fracture union was achieved in most cases with acceptable complication rates, consistent with international literature.

CONCLUSION

Locking plate fixation is a reliable and reproducible treatment option for periprosthetic femoral fractures with stable femoral stems. Successful management requires accurate preoperative planning, preservation of biological factors, stable fixation, and structured rehabilitation.

Long locking plates associated with cerclage fixation provide excellent mechanical stability and satisfactory clinical outcomes even in elderly osteoporotic patients.

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Citation: Priyabrata Dash, Birupakshya Mahakul, Raj Singh Kshatria, Sujay Podder, Dwarikanath Rout (2026). Effectiveness of Structured Physiotherapy in Guillain-Barre Syndrome: A Detailed Case Report. *EAS J Orthop Physiother, 8*(3): 60-63.