

Treatment of Trochanteric Fractures: Review Article

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Abstract:

Trochanteric fractures of the femur are among the most common injuries in the elderly, usually associated with osteoporosis and low-energy trauma such as falls. They represent a significant cause of morbidity, mortality, and loss of independence in the aging population.

Keywords: trochanteric fracture; Intertrochanteric fracture; Femoral fracture; Hip fracture; Osteoporosis; Internal fixation; Hemiarthroplasty; Elderly.

Introduction:

Trochanteric fractures, involving the region between the greater and lesser trochanters of the femur, account for nearly half of all hip fractures in older adults, making them a major public health concern (1).

These fractures are commonly caused by low-energy falls in elderly individuals with osteoporotic bone, although high-energy trauma can cause similar injuries in younger patients (2).

Management aims not only at achieving fracture union but also at restoring mobility as early as possible, since delayed ambulation is strongly associated with increased morbidity and mortality (3).

Treatment options include internal fixation devices, such as sliding hip screws and intramedullary nails, or arthroplasty in selected cases, depending on fracture stability and patient factors (4).

A. NON-OPERATIVE TREATMENT:

Non-operative management of trochanteric fractures has largely been replaced by surgical intervention over the past three decades. However, if non-operative care is considered, a thorough understanding of the anatomy and biomechanics of the trochanteric region is essential. The strong muscles of the hip and thigh often lead to severe post-fracture deformities. The iliopsoas and hip abductors cause the proximal fragment to flex, abduct, and externally rotate, while the adductor muscles contribute to shortening and varus deformity of the distal fragment (5).

In cases of severe comminution, skeletal traction may be considered when surgical expertise or appropriate implants are unavailable. While this approach avoids surgical risks (anesthesia complications, blood loss, infection), it carries significant drawbacks including prolonged hospitalization, difficulty maintaining reduction, and complications like knee stiffness and varus malunion. Traction is particularly contraindicated in elderly or multiply disabled patients due to high risks of deep vein thrombosis, pulmonary embolism, pneumonia, urinary tract infections, pressure ulcers, and nutritional deficiencies (6).

B. OPERATIVE TREATMENT:

Operative treatment remains the standard of care for trochanteric fractures, particularly for comminuted, unstable, or complex patterns. The primary goal is anatomic reduction and stable fixation to enable early mobilization and functional recovery. While implants like dynamic hip screws (DHS), dynamic condylar screws, and intramedullary nails yield favorable outcomes for stable fractures, the sliding hip screw (SHS) is widely preferred for these cases due to its low failure rates. However, SHS demonstrates significantly higher failure rates (4–15%) in unstable or subtrochanteric fractures, primarily due to varus collapse and hardware failure (7, 8).

Indications for Surgical Treatment:

1. Irreducible or unstable fractures.
2. Fractures in polytrauma patients.

3. Pathological fractures.
4. Significant obesity.
5. Fractures in elderly patients.

Relative Indications:

- Most fractures to minimize complications of prolonged immobilization.

Contraindications:

- Poor general health precluding surgery.
- Local skin conditions (e.g., burns, severe ecchymosis, or infection).

DYNAMIC HIP SCREW (DHS):

INDICATIONS

- Pertrochanteric fractures classified as AO/OTA type 31A1 and 31A2.
- Intertrochanteric fractures of type 31A3 with a stable lateral wall (ULTSP).
- Basilar neck fractures of type 31B1 (DHS used in conjunction with an anti-rotation screw).

ADVANTAGES

- Provides rigid fixation.
- Ensures effective compression at the fracture site.

DISADVANTAGES

- Requires a longer incision.
- Prolonged operative time.
- Increased blood loss and postoperative drainage.



Figure (1): Anteroposterior and lateral X-ray views of an osteoporotic patient with an intertrochanteric femoral fracture (AO/OTA 31-A1) of the right hip (a, b).

PROXIMAL FEMORAL NAIL (PFN):

The proximal femoral nail (PFN) was introduced in 1997 for the treatment of proximal femoral fractures (9).

INDICATIONS:

- Treatment of pertrochanteric, intertrochanteric, and subtrochanteric fractures classified as AO/OTA types 31-A1, 31-A2, and 31-A3 (9).
- Pathological fractures.
- Extended subtrochanteric fractures, particularly when using the long version of the implant.

ADVANTAGES:

- Lower intraoperative blood loss compared to other methods (e.g., dynamic hip screw and gamma nail).
- No need for reaming of the femoral canal.
- Enhanced rotational and angular stability due to the anti-rotation pin or screw.

DISADVANTAGES

- Risk of screw cut-out.
- Potential for implant failure.
- Higher cost of the implant (10).

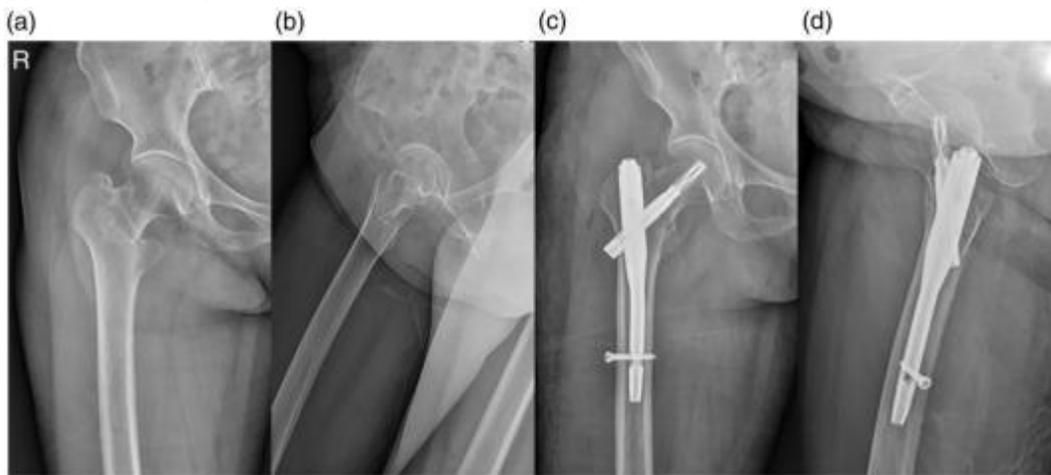


Figure (2): Anteroposterior and lateral X-ray views of an osteoporotic patient with an intertrochanteric femoral fracture (AO/OTA 31-A1) of the right hip (a, b). Postoperative anteroposterior and lateral X-ray views of the same patient undergoing proximal femoral nail antirotation fixation of an osteoporotic intertrochanteric femoral fracture of the right hip (c, d).

Proximal Femoral Locked Plate (PF-LCP):

INDICATIONS:

The proximal femoral locked plate is indicated for the following conditions (5):

1. **Complex fractures:** Proximal femur fractures with ipsilateral femoral shaft fractures.
2. **Pathological fractures:** Metastatic fractures of the proximal femur.
3. **Osteotomies:** Proximal femoral osteotomies.
4. **Osteopenic bone fractures:** Fractures in patients with poor bone quality.
5. **Non-unions and malignancies:** Non-union fractures or fractures associated with bone tumors.
6. **Femoral neck fractures:** Basal or transcervical femoral neck fractures require careful implant selection. Contemporary evidence indicates that cannulated screws, sliding hip screws, and dynamic condylar screws demonstrate superior biomechanical stability and clinical outcomes for vertical femoral neck fractures compared to proximal femoral locking compression plates (PF-LCP). These alternative fixation methods provide more effective resistance to shear forces in vertically oriented fracture patterns, reducing risks of fixation failure and nonunion (9, 10).
7. **Subtrochanteric fractures:** Particularly those extending into the piriform fossa represent a complex injury pattern where proximal femoral locking compression plates (PFLCP) provide effective fixation by enabling multiplanar screw placement to bypass the compromised zone while maintaining fracture reduction (11).
8. **Challenging cases:**

- Patients with short skeletons, small femoral canals, or severely bowed femurs.
- Adolescents with open growth plates.
- Fractures with pre-existing implants in the distal femur.
- Ipsilateral unstable pelvic or sacral fractures: Intramedullary nailing carries significant risks in these complex injury patterns, including compromised fracture reduction, destabilization of pelvic fixation, and iatrogenic neurovascular injury. Alternative fixation methods are recommended to avoid these complications (12).

ADVANTAGES:

The PF-LCP offers several benefits (5, 13, 14):

- **Lateral support:** Acts as a lateral buttress, reducing secondary fracture effects and femoral shaft medialization.
- **Improved alignment:** Minimizes varus angulation and limb shortening.
- **Greater trochanter repair:** Restores the biomechanical function of the gluteus medius.
- **Enhanced stability:** The inferomedial kickstand screw provides additional protection against collapse.
- **Bone preservation:** Maintains more bone stock compared to dynamic condylar screws (DCS) or blade plates.
- **Fewer complications:** Reduces risks such as varus collapse, hardware failure (e.g., screw cut-out), and limb shortening compared to dynamic hip screws (DHS) and DCS.
- **Ease of use:** Less technically demanding than angular blade plates or intramedullary nails.
- **Reduced postoperative issues:** Lower risk of intraoperative fat embolism, pelvitrochanteric discomfort, or postoperative limping compared to nails.

DISADVANTAGES:

1. Prevents Fracture Impaction:

- Fixed-angle constructs eliminate dynamic compression, delaying callus formation and increasing nonunion risk by 3.1× in unstable fractures (15).

2. High Technical Complexity:

- Percutaneous application requires precise fluoroscopic targeting, with malreduction occurring in 28% of cases (16).

3. Stress-Shielding & Periprosthetic Fractures:

- Rigid fixation creates stress risers at the plate end, leading to 8.7% distal periprosthetic fractures (17).

4. Suboptimal for Simple Fractures:

- Outperformed by sliding hip screws in stable patterns (31A1/31A2) with 22% higher revision rates (18).

5. Reduced Biomechanical Efficiency:

- 40% lower load-to-failure in osteoporotic bone compared to modern cephalomedullary nails (19).

ADDITIONAL NOTES:

- **Biomechanical advantages:** The PF-LCP provides angular stability, making it suitable for osteoporotic bone and complex fracture patterns.
- **Patient selection:** Ideal for patients who are not candidates for intramedullary nailing due to anatomical constraints or comorbidities.
- **Postoperative care:** Early mobilization is encouraged to prevent complications associated with prolonged immobilization.



Figure (3): (a) A reverse oblique fracture (AO type 31-A3.3) is fixed with the proximal femoral locking compression plate.

UNILATERAL EXTERNAL FIXATION:

INDICATIONS:

Unilateral external fixation is particularly suitable for open fractures, elderly patients with significant medical comorbidities, such as diabetes mellitus, hypertension, stroke, or cardiopulmonary conditions, who are unable to tolerate major surgical procedures requiring prolonged operative times and posing risks of excessive bleeding. Additionally, these patients are often poor candidates for conservative treatment due to the high risk of complications associated with prolonged immobilization, such as pressure ulcers, deep vein thrombosis, and pneumonia.

ADVANTAGES:

- **Shorter operative time:** The procedure is less time-consuming compared to internal fixation methods.
- **Cost-effective:** It is an inexpensive alternative to more complex surgical interventions.
- **Reduced hospital stay:** Patients typically require less time in the hospital, which is beneficial for elderly or medically fragile individuals.

DISADVANTAGES:

- **Pin tract infections:** A common complication associated with external fixation.
- **Prolonged union time:** Fracture healing may take longer compared to internal fixation methods.
- **Varus malalignment:** Increased risk of the fracture site healing in a varus position.
- **Inferior functional outcomes:** Patients may experience reduced mobility and functional recovery compared to those treated with internal fixation.

ADDITIONAL NOTES:

- **Patient selection:** Ideal for high-risk patients who cannot undergo extensive surgery or prolonged immobilization.
- **Postoperative care:** Regular monitoring for pin site infections and early mobilization are essential to minimize complications.



Figure (4): Anteroposterior radiograph of an unstable intertrochanteric fracture fixed by external fixator.

Complications of Trochanteric Fractures

Trochanteric fractures are associated with several local and systemic complications. Local complications include nonunion, malunion, implant failure, fixation failure, and infection. Systemic complications like deep vein thrombosis, pulmonary embolism, pneumonia, urinary tract infections, pressure ulcers, and nutritional deficiencies are more prevalent in elderly patients and require careful management (20).

1. NONUNION:

Nonunion occurs when a fracture fails to heal within 3-6 months. Patients with persistent weight-bearing pain after 6 months should undergo radiographic evaluation (21).

Risk Factors:

- AO/OTA 31-A3.3 fractures show prolonged healing due to lesser trochanteric involvement and posteromedial defects compromising stability (22).
- Infection should be ruled out via blood tests, imaging, and cultures. If absent, mechanical factors are primary (23).

2. MALUNION:

- Malunion involves improper healing leading to length, rotational, or angular deformities.

Length Discrepancy:

- >1.25 cm shortening may require shoe lifts. Prevention during initial surgery is critical (24).

Rotational Malalignment:

- >15° rotational deformities impair gait. Intraoperative alignment assessment is essential (25).

Varus Malalignment:

- >10° varus collapse causes Trendelenburg gait. Valgus osteotomy may be needed but prevention is preferable (26).

3. IMPLANT FAILURE:

- Occurs when biomechanical stresses exceed implant strength.

Risk Factors:

- Improper implant selection/technique. Intramedullary devices are preferred; extra medullary failures require conversion to intramedullary fixation (27).

4. FIXATION FAILURE:

- Linked to osteoporosis or technical errors.

Common Issues:

- Superior screw cut-out from improper placement above femoral head center.
- Screw penetration in osteoporotic bone, especially with non-compliant elderly patients (28).
- Higher sliding rates with proximal femoral nails vs. gamma nails (29).

5. PERI-IMPLANT FRACTURES:

- Significant concern with short intramedullary nails.

Causes:

- Stress concentration at nail tip/distal locking screws.
- PF-LCP failure from secondary reduction loss, often requiring revision (30).

6. INFECTION:

- Serious complication, especially in open fractures.

Diagnosis and Management:

- Acute infections typically present within 14 days post-surgery.
- Use CRP/ESR, MRI, and aspiration for diagnosis.
- Treatment: Irrigation, debridement, 6-week antibiotics. Severe cases may require antibiotic beads (31).

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