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Original Research Article

Classic Versus New Approaches in Management of Intertrochanteric Femur Fractures: Comparative Advantages and Side Effects

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Abstract:

Background: Intertrochanteric femur fractures constitute a common orthopedic injury, especially in the elderly. Management strategies have evolved from classic techniques such as Dynamic Hip Screw (DHS) to newer modalities, including Proximal Femoral Nail Anti-rotation (PFNA), Gamma nails, minimally invasive plate osteosynthesis (MIPO), and hip arthroplasty. This paper reviews and compares classic and contemporary management techniques, highlighting their benefits and side effects.

Methods: A review of randomized controlled trials, meta-analyses, cohort studies, and clinical reports (2008–2025) comparing traditional and new operative modalities for intertrochanteric femur fractures. Key outcome measures include functional recovery (Harris Hip Score), complications, operative metrics, and patient quality of life.

Results: Classic DHS remains cost-effective and reliable for stable fractures but is associated with longer surgical time and delayed mobilization. Intramedullary nails and PFNA show reduced surgical time, earlier weight-bearing, and higher union rates, but with risks of implant-related complications. Hip arthroplasty—though traditionally reserved for fracture fixation failure—now sees expanded use in selected elderly populations, offering superior early mobilization and functional scores. MIPO and locking plates deliver high union rates for comminuted fractures and decrease infection and soft tissue complications.

Conclusions: While classic methods like DHS are ideal for stable fractures, newer techniques (PFNA, Gamma nail, MIPO, and arthroplasty) provide improved outcomes in unstable or osteoporotic bones. Choice of therapy should be individualized, considering patient comorbidities, bone quality, fracture pattern, and expected rehabilitation.

Introduction

Intertrochanteric femur fractures have a bimodal distribution, predominantly affecting the elderly after trivial trauma due to osteoporosis. Management aims at restoring function rapidly while minimizing complications such as implant failure, infection, and delayed union. The past two decades have witnessed significant advances in implant design and surgical approach—from classic extramedullary devices like DHS to advanced intramedullary nails (Gamma, PFN, PFNA), plate osteosynthesis (MIPO), and femoral head replacements. This paper provides a comparative analysis of classic and contemporary approaches to treating intertrochanteric fractures, focusing on functional outcomes, complications, and technical issues.

Material and Methods

Classic Management Strategies

A. **Dynamic Hip Screw (DHS)** DHS fixation, introduced decades ago, remains the gold standard for stable intertrochanteric fractures. Benefits include:

- Reliable fixation
- Lower cost and widespread availability
- Proven long-term outcomes for stable fracture patterns

Drawbacks:

- Higher risk of cut-out in unstable fractures
- Prolonged surgical time and soft tissue exposure
- Delayed mobilization in osteoporotic bone
- Higher transfusion rates compared to nails

B. **Sliding Hip Screw (SHS)** Similar technically to DHS; efficacy established for A1/A2 pattern

fractures. Associated with lower complication rates and cost.

New Approaches in Management

C. **Intramedullary Nailing (PFN, PFNA, Gamma Nail)**

Advantages:

- Reduced operative time and blood loss
- Early weight-bearing, crucial in elderly
- Biomechanical superiority for unstable, osteoporotic fractures
- Minimized risk of varus collapse and fixation failure
- Lower reoperation rates with newer Gamma3 nails

Side Effects:

- Risk of intraoperative femoral shaft and distal cortical fracture
- Postoperative thigh pain, implant complications (cut-out, Z-effect)
- Higher cost than DHS/SHS
- Technical difficulty and learning curve

The PFNA antirotation blade compacts cancellous bone, aiding osteoporotic fracture fixation. PFNA and Gamma nails are preferred for unstable or comminuted fractures.

D. **Minimally Invasive Plate Osteosynthesis (MIPO)**

Advantages:

- High union rates with minimal soft tissue disruption
- Lower infection rates
- Better functional outcomes for comminuted and complex fractures
- Preserves periosteal blood supply, reducing healing time

Side Effects:

- Malalignment risk, technical demand
- Screw breakage in cluster configuration
- Not suitable for severe osteoporosis or unstable patterns

E. **Hip Arthroplasty (Total Hip/Bipolar Hemiarthroplasty)**

Indications:

- Failure of internal fixation
- Comminuted or highly unstable fractures in elderly
- Poor bone quality or pre-existing arthritis

Advantages:

- Immediate mobilization and weight-bearing
- Superior early functional scores
- Reduced risk of secondary displacement
- Lower rates of decubitus and postoperative complications

Side Effects:

- Higher operative time and blood loss
- Risk of dislocation and infection
- Technical challenges in poor bone stock
- Long-term outcomes favoring internal fixation in certain patients

Observation Table

Comparative Outcomes

Technique	Indication	Main Advantages	Side Effects/ Limitations
DHS/SHS	Stable, simple fractures	Cost-effective, reliable	Delayed mobilization, blood loss, cut-out in unstable, prolonged rehab
PFN/PFNA	Unstable, osteoporotic	Early weight bearing, biomech. support	Risk of shaft fracture, thigh pain, higher cost, implant complications
Gamma Nail	Unstable/multifragmentary	Improved biomech, lower complications (G3N)	Technical demand, cost
MIPO	Comminuted/proximal/distal	Minimally invasive, fast union	Malalignment, technical challenge
Arthroplasty	Elderly/failed fixation	Immediate full weight bearing, lower reoperation	Blood loss, risk of dislocation/infection, selection bias

Discussion

Intertrochanteric femur fractures represent one of the most common fractures encountered in elderly populations, carrying significant morbidity, mortality, and financial burden. Management strategies have evolved over the decades, with operative approaches such as dynamic hip screw (DHS), proximal femoral nail (PFN), and hip arthroplasty emerging as the cornerstones of treatment. Selection of fixation method for intertrochanteric femur fractures should depend on the individual's fracture pattern,

comorbidity, bone quality, and expected rehabilitation. DHS remains sufficient for select stable fractures, with intramedullary devices showing clear advantages in unstable or elderly populations. PFNA and Gamma nail provide superior outcomes in unstable/comminuted fractures due to improved biomechanical support and minimally invasive surgery.

The choice of technique depends on fracture pattern, patient age, bone quality, comorbidities, and expected functional outcomes. This discussion critically analyzes the comparative advantages and side effects of these modalities based on contemporary evidence.

Dynamic Hip Screw (DHS): The dynamic hip screw has historically been the standard of care for stable intertrochanteric fractures. Its biomechanical principle involves controlled collapse and impaction at the fracture site, promoting union. DHS is advantageous in stable fracture patterns (AO 31-A1 and A2), offering familiarity to surgeons, relatively simple instrumentation, and cost-effectiveness. However, DHS demonstrates limitations in unstable and reverse oblique patterns, where excessive collapse, limb shortening, and fixation failure are more frequent. Increased operative time and blood loss compared to PFN are also noted drawbacks. Side effects include screw cut-out, excessive sliding, infection risk, and implant breakage in osteoporotic bone.

Proximal Femoral Nail (PFN): Intramedullary fixation using PFN has gained popularity due to superior biomechanical stability, especially in unstable fractures (AO 31-A3) and osteoporotic bone. The intramedullary location provides a shorter lever arm, reducing stress on the implant and lowering failure rates in complex fractures. PFN is associated with shorter surgical time, less blood loss, reduced soft-tissue dissection, and early weight-bearing compared to DHS. Complications include technical difficulty in insertion, greater radiation exposure, risk of femoral shaft fracture at the tip, and malpositioning of screws. Recent evidence suggests distal unlocking may be omitted in stable fractures to reduce operative time and blood loss without compromising outcomes.

Hip Arthroplasty: Hip arthroplasty serves as an alternative in elderly patients with poor bone quality, preexisting hip arthritis, or fractures deemed at high risk of fixation failure. Arthroplasty offers immediate stability, allowing rapid mobilization, which is crucial in frail patients at risk of complications from prolonged immobility. Bipolar hemiarthroplasty or total hip replacement may be considered based on individual patient needs. Advantages include early functional recovery and lower reoperation rates. However, arthroplasty entails higher initial surgical trauma, greater blood loss, increased risk of infection, dislocation, and higher perioperative mortality compared to fixation techniques. Long-term functional outcomes may not significantly surpass those achieved with PFN.

Cost-Effectiveness Considerations: Economic burden remains an important factor in implant selection. Decision-analysis models indicate DHS is more cost-effective for stable fracture patterns, whereas PFN is superior for unstable or reverse oblique fractures. Although arthroplasty involves higher upfront costs, it may be justified in select patients due to reduced complication-related reoperations. Cost-effectiveness is influenced by fracture stability, implant cost, and failure rates.

Comparative Analysis: When comparing DHS and PFN, studies consistently demonstrate PFN superiority in unstable and osteoporotic fractures, providing earlier mobilization, less limb shortening, and lower mechanical failure rates. DHS remains reliable in stable patterns but carries increased risks in unstable fractures. Arthroplasty provides immediate mobility but carries higher perioperative risks and cost, making it most suitable for elderly frail patients with high risk of fixation failure. Thus, treatment choice must be individualized based on patient and fracture characteristics, balancing surgical risks, functional demands, and cost. Complication rates, most notably implant-related failures, and risk of infection, must always be factored in the choice of technique. Evidence suggests that tailored approaches employing newer modalities in high-risk fractures result in optimal outcomes, though cost and resource availability remain global concerns.

Future Directions: Emerging trends favor arthroplasty for high-risk elderly with poor bone quality or fixation failure, enabling immediate mobility and improved quality of life. Nevertheless, higher blood loss and technical complexity require consideration. Minimally invasive techniques such as MIPO offer promising results, especially for comminuted fractures, though technical expertise is essential.

Advancements in implant design, minimally invasive surgical techniques, and integration of orthogeriatric co-management are expected to refine outcomes. Randomized controlled trials comparing PFN, DHS, and arthroplasty with long-term follow-up are necessary to establish definitive guidelines. Further studies should also focus on optimizing rehabilitation protocols, perioperative care, and stratifying patients who benefit most from each intervention.

Conclusion

In summary, DHS remains effective for stable fractures, PFN is preferred for unstable patterns and osteoporotic bone, and arthroplasty is reserved for elderly patients with poor bone stock or high risk of fixation failure. Each technique carries distinct advantages and limitations. Individualized, evidence-

based decision-making supported by multidisciplinary care offers the best outcomes in managing intertrochanteric femur fractures.

Intertrochanteric femur fractures management has evolved from classic extramedullary fixation to advanced intramedullary techniques, minimally invasive methods, and arthroplasty. Each option has defined indications, benefits, and risk profiles. Treatment should be individualized—considering the fracture type, patient age, bone quality, and functional demand—to maximize outcomes and limit adverse events.

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