

INTRODUCTION

Proximal femoral fractures, more generally termed 'hip fractures', are among the most common injuries and can be subdivided into intracapsular fractures (those occurring proximal to the attachment of the hip joint capsule to the femur) and extracapsular (those occurring distal to the hip joint capsule). Extracapsular fractures are those which traverse the femur within the area of bone bounded by the intertrochanteric line proximally up to a distance of five centimetres below the distal part of the lesser trochanter. Femoral intertrochanteric fractures, accounting for about 50% of hip fractures, are one of the common fractures in elderly patients.¹ (Fig. 1)

Pertrochanteric femoral fractures are of intense interest globally. They are the most frequently operated fracture type, have the highest postoperative fatality rate of surgically treated fractures, and have become a serious health resource issue due to the high cost of care required after injury. The reason for the high cost of care is primarily related to the poor recovery of functional independence after conventional fracture care in many patients.²

Classifications for extracapsular fractures of the hip occurring from the basicervical to the level of the subtrochanteric regions have not been particularly helpful in clinical situations. However, increased surgical complexity and recovery is associated with unstable fracture patterns. Unstable

characteristics include posteromedial fragmentation, basicervical patterns, reverse obliquity patterns, displaced greater trochanteric (lateral wall) fractures, and failure to reduce the fracture prior to internal fixation.³

Unfortunately, sliding implant systems may result in significant deformity. The current controversy of implant selection is largely focused on what amount of deformity and fracture site motion is still compatible with a complete functional recovery. Since original reports of surgical repair for pertrochanteric fractures, the literature has revealed certain fracture patterns which are not amenable to simple screw/nail side plate devices, such as subtrochanteric fractures, reverse obliquity fractures, and fractures with lateral wall fracture extension.⁴

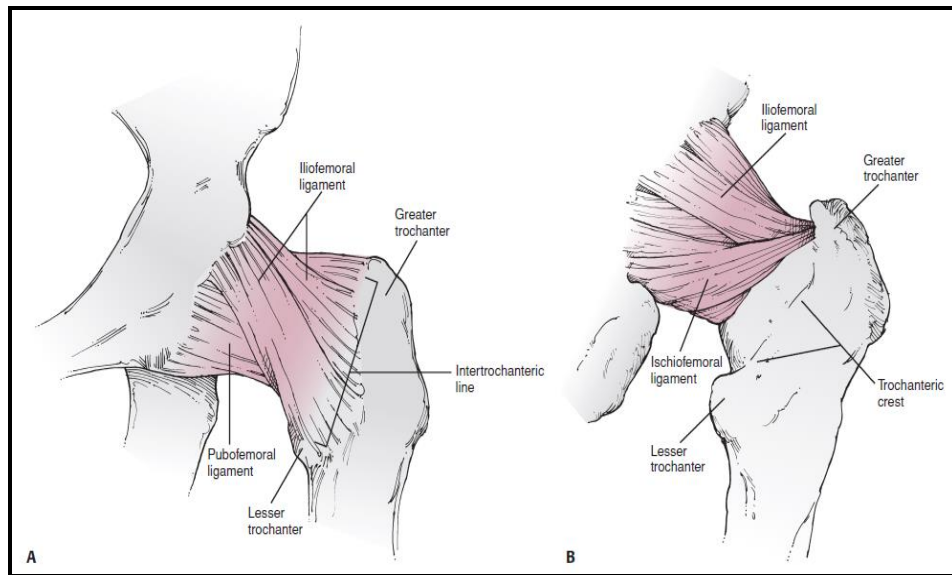


Figure 1: A: Anterior hip capsule. Y-Ligament of Bigelow is structure critical for ligamentotaxis in closed reduction of stable fractures. **B:** Posterior hip capsule. Note more proximal position of capsule posteriorly and course of arteries to head.

In 1949, Boyd and Griffin described the first treatment recommendation classification, predictive of the difficulty of achieving, securing, and maintaining the reduction in four fracture types:

1. Stable (two-part)
2. Unstable with posteromedial comminution
3. Subtrochanteric extension with lateral shaft extension of the fracture distally at or just below the lesser trochanter (termed “reverse obliquity” by Wright⁵)
4. Subtrochanteric with intertrochanteric extension with the fracture lying in at least 2 planes (Fig. 2).⁶

Also in 1949, Evans (Birmingham, England) reported on post-treatment classification with five types described. He compared non-operative treatment and fixed-angle device surgical treatment. He documented that 72% of his fractures could be fixed in a stable configuration. In 28% of the fractures stability was not achieved; 14% as a result of the fracture pattern or comminution and 14% of which he felt the reduction was never achieved (Fig. 3).⁷

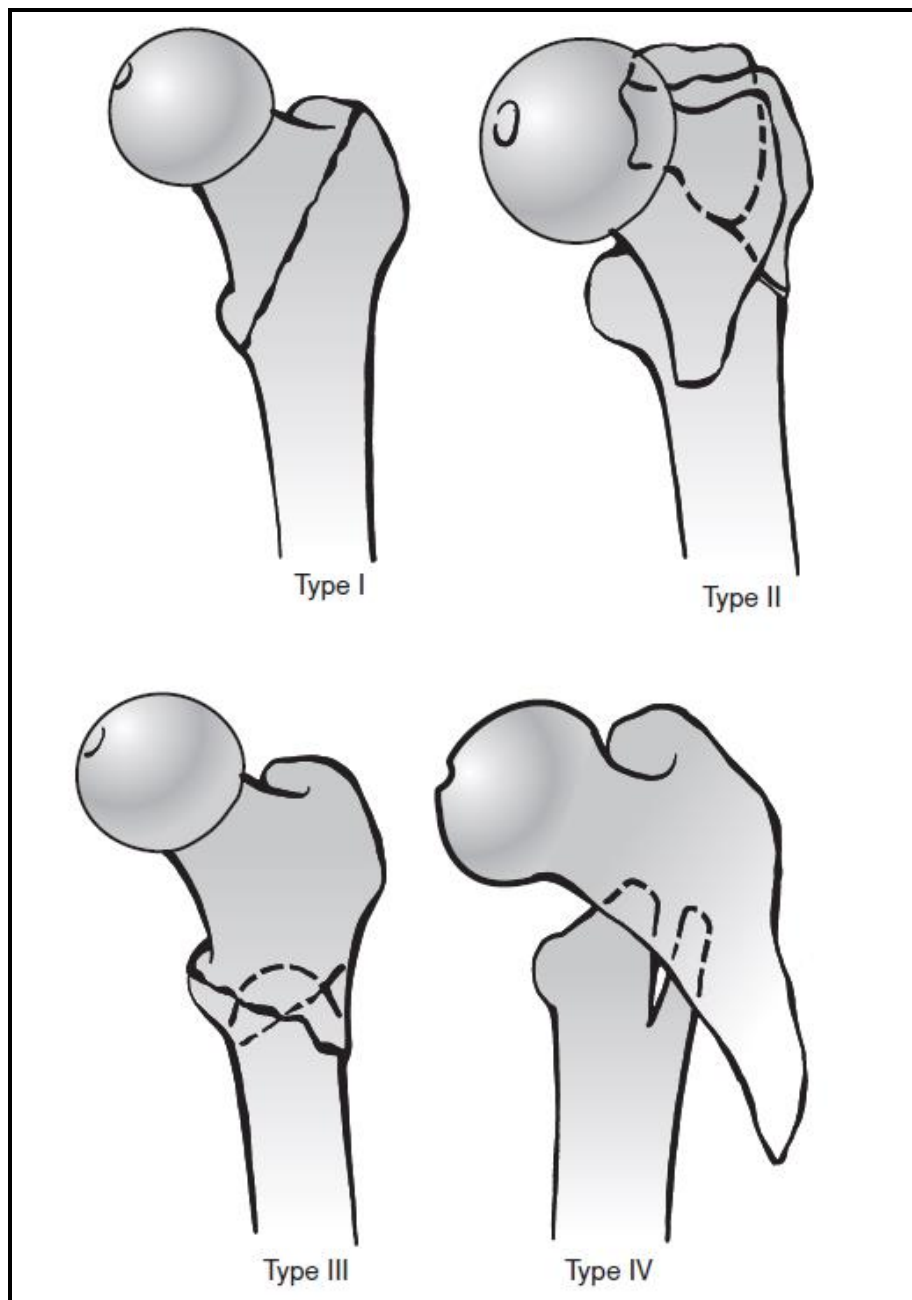


Figure 2: Boyd and Griffin classification. Type 1, stable (two-part); Type 2, unstable comminuted; Type 3, unstable reverse obliquity; Type 4, intertrochanteric–subtrochanteric with two planes of fracture.

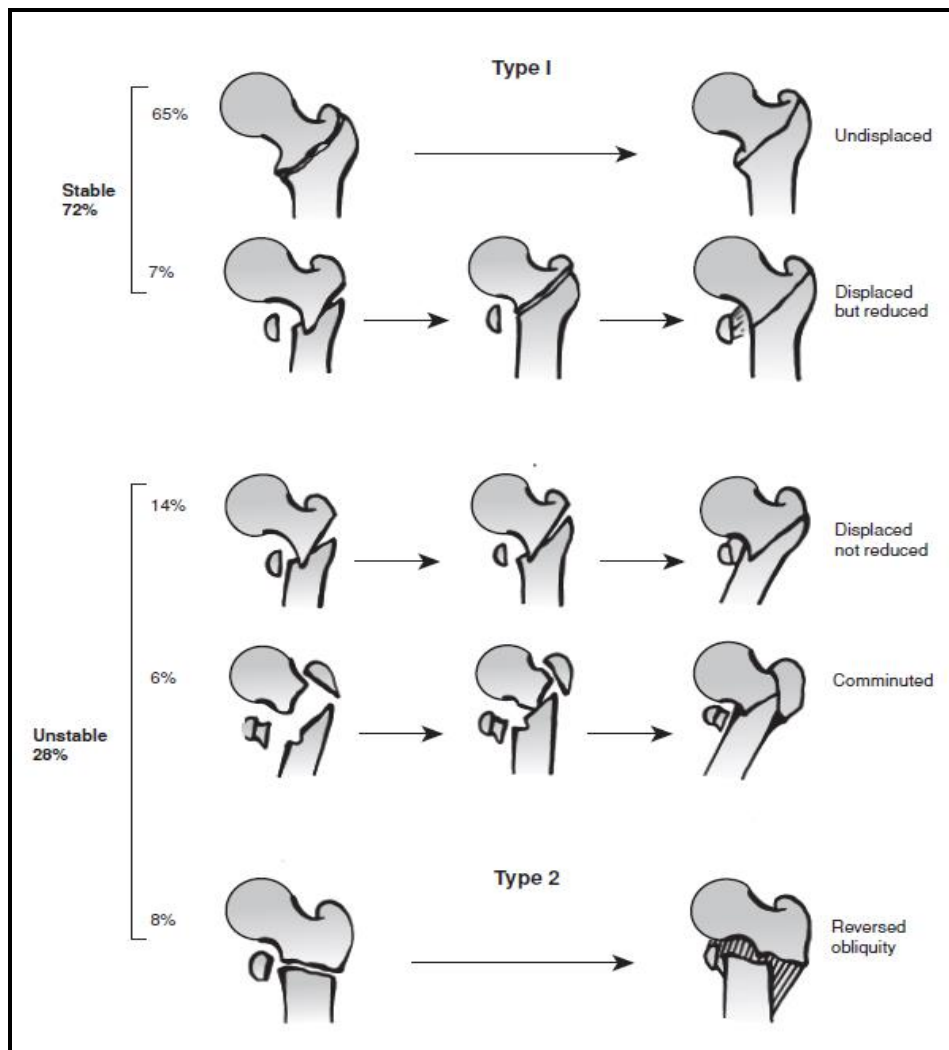


Figure 3: Evans classification of trochanteric fractures. **Type 1, stable:** Either not displaced or displaced but anatomically reduced (intact medial cortex). **Type 2, unstable:** Implies displaced and fixed in an unreduced position, comminuted with destruction of the anteromedial cortex, or reverse obliquity.

The AO/OTA (Arbeitsgemeinschaft für Osteosynthesefragen/ Orthopaedic Trauma Association) classification is the most referenced in recent scientific articles and is a derivative of the Muller classification (Fig. 4).⁸ The

AO/OTA has nine main “types,” however correlation is best with only level 3 designation: 31A1, 31A2, and 31A3 categories; also there is no lateral radiographic parameter with the AO/OTA classification. Generally, the 31A1 fracture is the most stable, 31A2 more unstable, and the 31A3 the most unstable with SHS fixation.^{9,10}

In the OTA fracture classification, intertrochanteric hip fractures comprise type 31A. These fractures are divided into three groups, and each group is further divided into subgroups based on obliquity of the fracture line and degree of comminution:

Group 1 fractures are simple (two-part) fractures, with the typical oblique fracture line extending from the greater trochanter to the medial cortex. The lateral cortex of the greater trochanter remains intact.

Group 2 fractures are comminuted with a posteromedial fragment. The lateral cortex of the greater trochanter, however, remains intact. Fractures in this group are generally unstable, depending on the size of the medial fragment.

Group 3 fractures are those in which the fracture line extends across both the medial and lateral cortices. This group includes the reverse obliquity pattern.

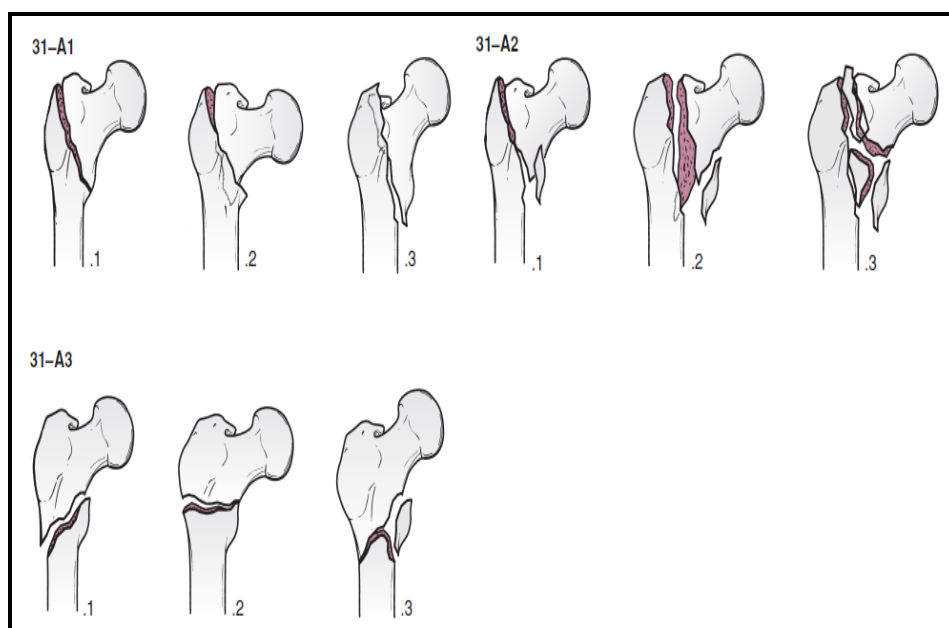


Figure 4: The OTA intertrochanteric fracture classification.

Non-operative treatment should only be considered in non-ambulatory or severely demented patients with controllable pain, or patients with terminal disease. Severe medical comorbidities that preclude surgical treatment and active infectious diseases that preclude insertion of a surgical implant are also relative contraindications. An exception to this consideration is incomplete pertrochanteric fractures diagnosed by MRI, which have shown to heal with conservative measures in selective patients. Mobilization is necessary to minimize decubiti, pneumonia, and dementia.^{11,12}

Non-operative treatment includes bed rest with the lower extremity in extension and braced with pillows or pads for 1 to 2 weeks is usually required for pain control. Femoral or proximal tibial traction is usually only necessary in patients

with subtrochanteric extension or preoperative flexion contractures of the hip. Non-operative management must include attentive nursing care with frequent positioning to avoid decubiti, attention to nutrition and fluid homeostasis, and adequate analgesics/narcotic pain suppression. Fracture callus formation at 3 weeks markedly decreases motion-related pain and by 6 weeks most patients can be lifted into a wheelchair or reclining chair. Union occurs in 12 to 16 weeks.¹³

However, pertrochanteric fractures are globally viewed as an injury best treated with surgical repair. Multiple modalities of surgical treatment must be mastered and available for the surgeon's treatment since the fracture patterns are not uniform, the morphology of the femur has significant variation, and due to the comorbidities of the elderly patient. Surgical management once selected should be performed as soon as any correctable metabolic, hematologic, or organ system instability has been rectified. This is within the first 24 to 48 hours for most patients.²

There is a considerable debate regarding which is the optimal implant for fixing intertrochanteric fractures. Both intramedullary fixation and extramedullary fixation are surgical techniques for the treatment of intertrochanteric fractures, and there are multiple choices for intramedullary and extramedullary devices.¹⁴

Sliding hip screws (Fig. 5-A:6), dynamic condylar screw (DCS), percutaneous compression plate (Fig. 9), Compression hip screw (Fig. 7), Madoff sliding plate (Fig. 5:B), Hybrid locking plate system (Fig. 10:11) and the less invasive stabilization system (LISS) are widely applied in extramedullary fixation, whereas gamma nail (GN) (Fig. 12-B), Holland nail, proximal femoral nail (PFN), proximal femoral nail antirotation (Fig. 12-F:14), trochanteric fixation nail (Fig. 12-A), intramedullary hip screw (IMHS) and Targon PF (proximal femoral) nail (Fig. 15) are commonly used for intramedullary fixation.¹⁴

Sliding hip screw (SHS), the most representative implant of extramedullary fixation, has been considered the gold standard for treatment of stable intertrochanteric fractures. However, SHS often fails to give good results in the unstable and reverse oblique fracture, which limits its clinical use.^{14,15}

Gamma nail has been widely used for many years because of its inspiring clinical results.^{16,17} Long-term studies, however, revealed that Gamma nail might cause higher intra-operative and late complications that often require revision surgery.^{18,19} Proximal Femoral Nail Anti-rotation (PFNA) was designed to minimize the risk of these implant-related complications, and preliminary results suggested that this goal might have been achieved.^{20,21}

PFNA provides angular and rotational stability, which is especially important in osteoporotic bone, and allows early mobilization and weight bearing on the affected limb.^{22,23}

So this study will try to examine the extent to which current evidence about the effectiveness of extramedullary compared to intramedullary techniques in surgical treatment of unstable intertrochanteric femoral fractures.

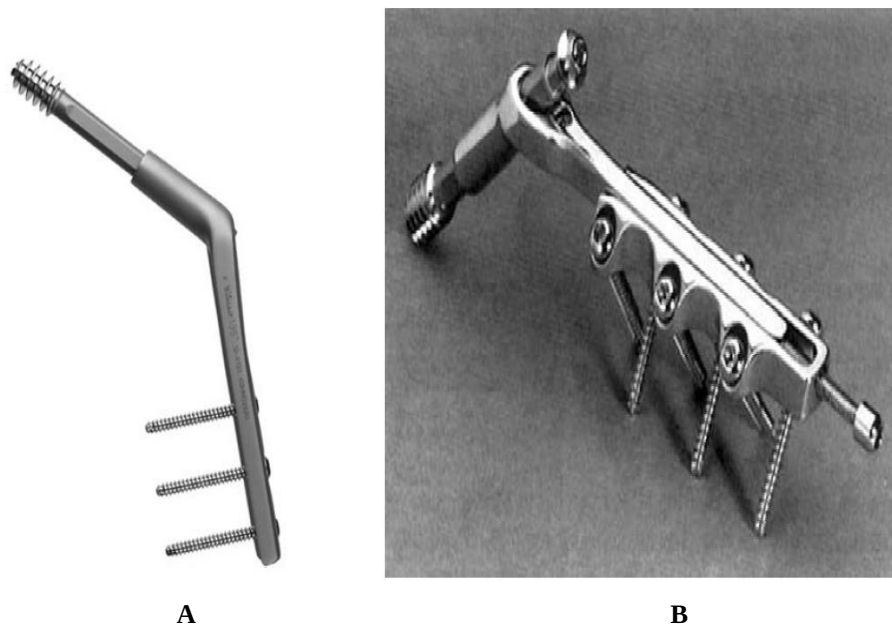


Figure 5: Showing A) sliding hip screw and B) Madoff sliding plate.

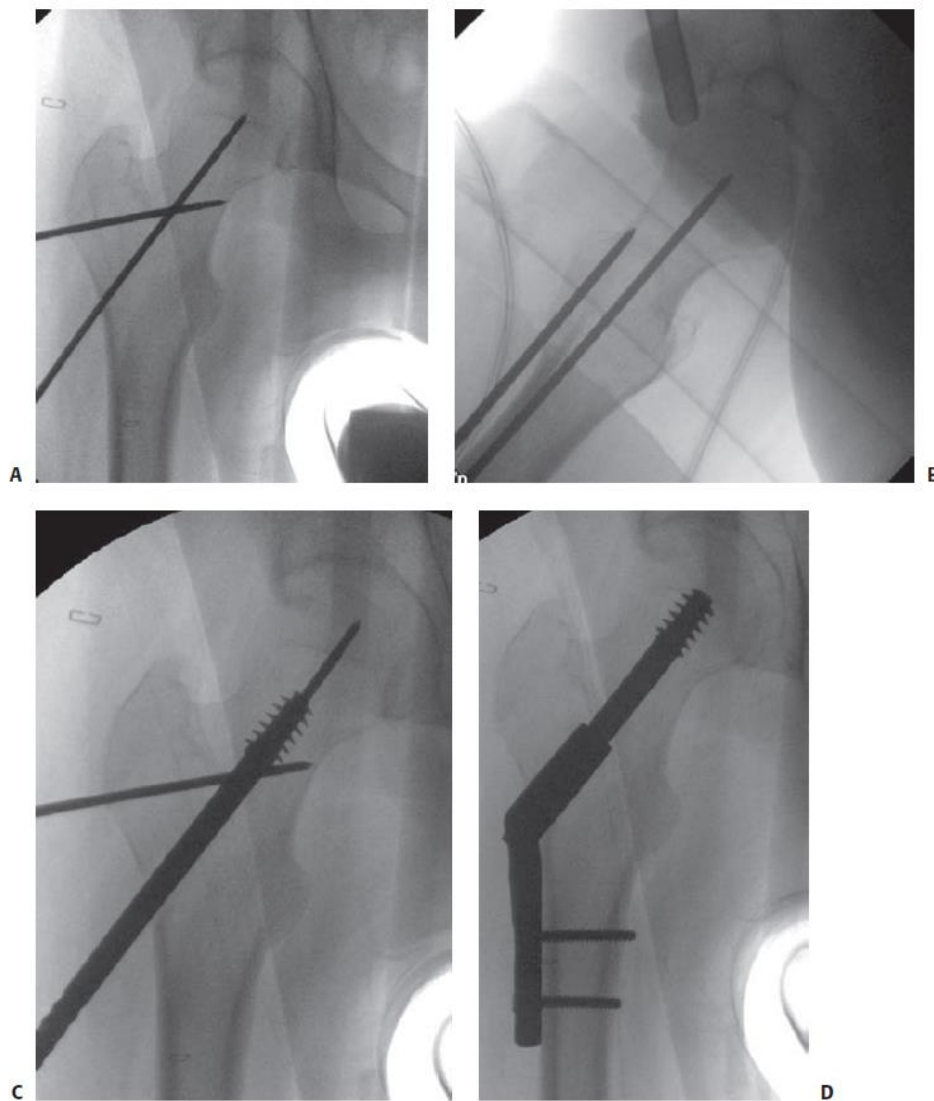


Figure 6: **A:** Sliding hip screw technique. Provisional fixation lateral to medial proximal femoral neck region, AP view. **B:** Lateral view. Note parallel placement anterior to center-center guidewire. **C:** Insert lag screw to within 5- to 10-mm subchondral bone maintaining provisional antirotation pin in place. **D:** AP view 135-degree two-hole plate in proper alignment.



Figure 7: **A:** High-energy fracture. **B:** Reduction and stabilization with CHS. Good position with good bone stock aids the stability of the fixation with CHS. **C:** Lateral postoperative radiograph. **D:** Malreduction with plate angle too high inducing medial opening of the fracture. **E:** Anterior translation of fracture with wrong angle plate.

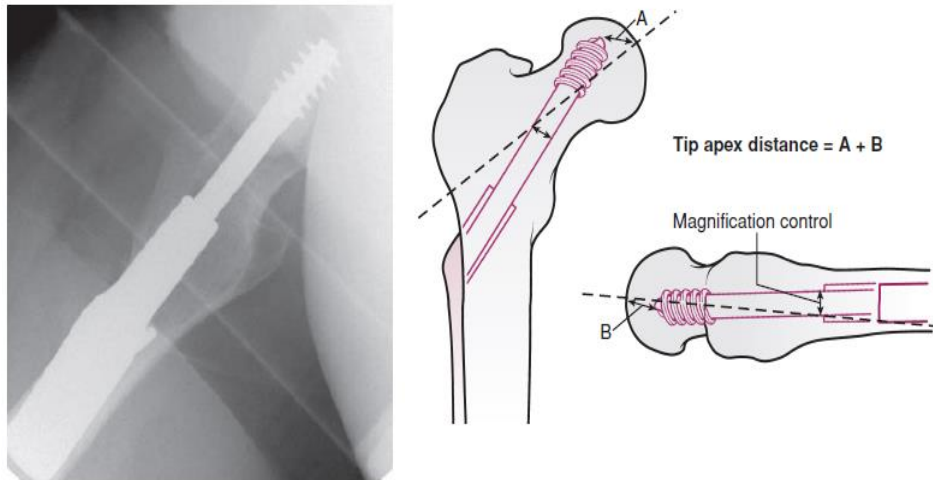


Figure 8: Showing **A:** Lateral view with correct insertion of screw parallel to anterior neck. **B:** The tip-apex distance (TAD), expressed in millimeters, is the sum of the distances from the tip of the lag screw to the apex of the femoral head on both the AP and lateral radiographic views. The TAD should be less than 25 mm as described by Baumgartner.

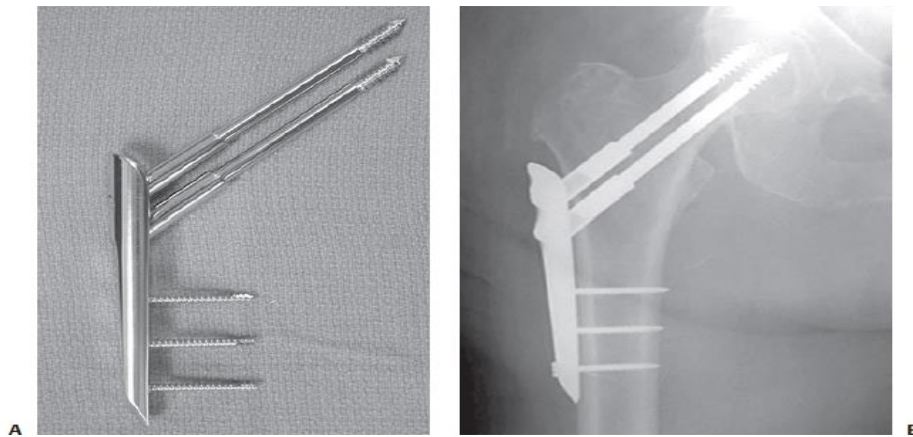


Figure 9: Showing **A:** Percutaneous compression plate (PCCP). **B:** PCCP reduction and fixation. Note inferior placement of bottom screw and protection of the greater trochanter by distal plate position.

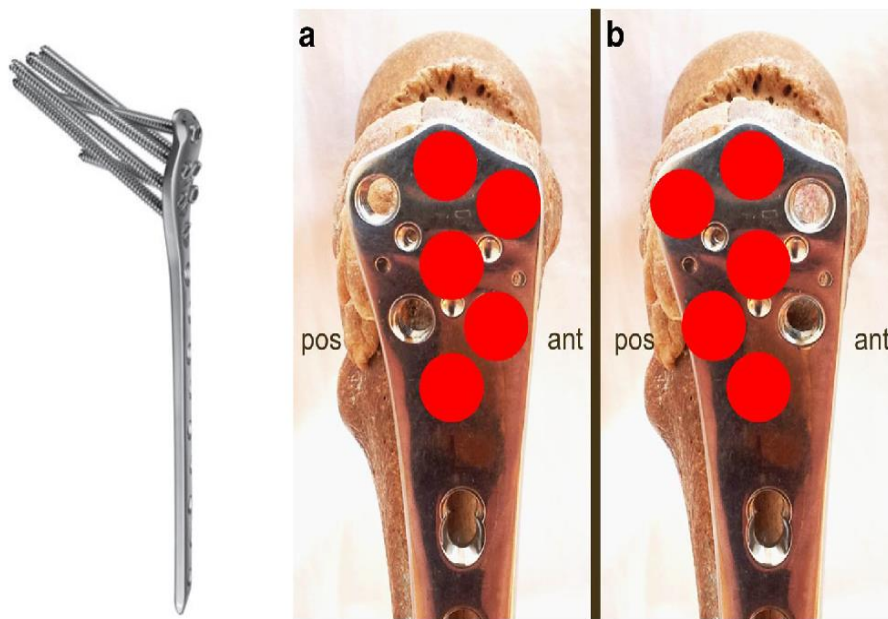


Figure 10: Showing Hybrid locking plate system and the seven proximal holes of the reverse distal femoral locking compression plate (reverse-DFLCP).

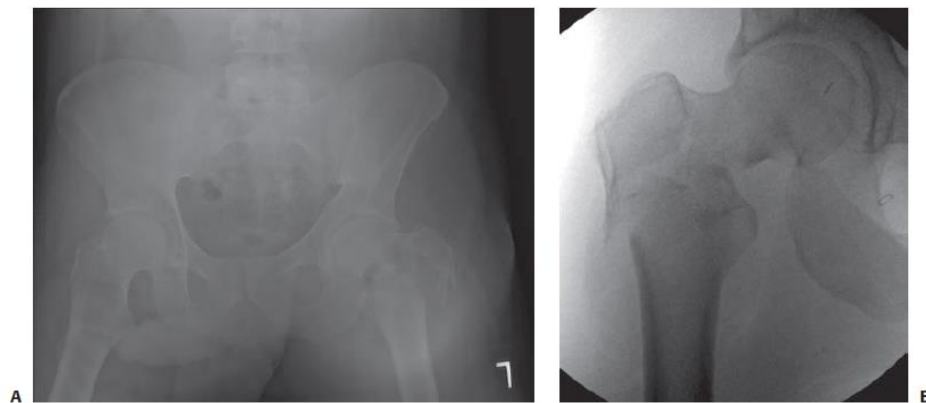


Figure 11: **A:** High-energy pertrochanteric fracture. **B:** AP radiograph traction view.