DYNAMIC HIP SCREW VERSUS PROXIMAL FEMORAL NAIL IN MANAGEMENT OF INTERTROCHANTERIC FRACTURES: AN OVERVIEW

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Abstract

Background: Intertrochanteric hip fractures are extra-capsular fractures of the proximal femur that occur between the greater and lesser trochanters. Those fractures are one of the most common fractures encountered in orthopedic practice. They represent about 50% of all hip fractures. Epidemiological studies have shown increasing incidence of proximal femoral fractures, due to life expectancy of the general population during the past few decades. More than 90% of patients are elderly individuals usually due to low-energy trauma. Deep venous thrombosis, pulmonary embolism, hypostatic pneumonia urinary tract infection and bed sores are serious complications threaten patient with trochanteric fractures due to prolonged immobilization specifically in elderly patients in whom the osteoporosis and instability of the fractures restricts intensely the ambulation due to highly limited weight bearing. Operative treatment is the best option for most cases of trochanteric fractures. Immediate internal fixation of trochanteric fractures has been accepted as the standard procedure for most patients. The goal of treatment of trochanteric fractures is obtaining an accurate reduction and stable fixation that allow early mobilization, thereby reducing the incidence of complication and achieving good functional recovery.

Conclusion: We concluded that in stable trochanteric fractures, both the PFN and DHS nearly have similar optimal functional outcomes. Further studies are requested to analyze all aspects of this issue.

Key words: Intertrochanteric, Fracture, DHS, PFN.

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INTRODUCTION:

Intertrochanteric hip fractures are extra-capsular fractures of the proximal femur that occur between the greater and lesser trochanters. Those fractures are one of the most common fractures encountered in orthopedic practice. They represent about 50% of all hip fractures. Epidemiological studies have shown increasing incidence of proximal femoral fractures, due to life expectancy of the general population during the past few decades (1). More than 90% of patients are elderly individuals usually due to low-energy trauma. Deep venous thrombosis, pulmonary embolism, hypostatic pneumonia urinary tract infection and bed sores are serious complications threaten patient with trochanteric fractures due to prolonged immobilization specifically in elderly patients in whom the osteoporosis and instability of the fractures restricts intensely the ambulation due to highly limited weight bearing (2).

Intertrochanteric fractures are classified as stable or unstable, depending on the integrity of the posteromedial (calcar) and lateral (greater trochanter) buttresses and on the obliquity of the fracture line The problems of instability of those fractures mainly related to discontinuity of lateral wall of the proximal femur rather than destruction of medial femoral component as previously thought (3). So, the intact stable lateral wall of the proximal femur plays a key role in stabilization of unstable intertrochanteric fractures by providing a lateral buttress for the proximal fragment thus preventing excessive fracture collapse, significant limb shortening, varus malposition and fixation failure (4).

Operative treatment is the best option for most cases of trochanteric fractures. Immediate internal fixation of trochanteric fractures has been accepted as the standard procedure for most patients. The goal of treatment of trochanteric fractures is obtaining an accurate reduction and stable fixation that allows early mobilization, thereby reducing the incidence of complication and achieving good functional recovery (5). Several devices have been developed for this goal, with the main options including intramedullary nails and dynamic hip screw systems. In the last two decades, the surgical treatment of intertrochanteric fractures has shown a continuing trend towards the increased use of intramedullary nails, however, for unstable fracture patterns the best treatment remains controversial (6).

The Dynamic Hip Screw (DHS) is one of best options for internal fixation of Intertrochanteric fractures. Over several years, the DHS has demonstrated effective stabilization of trochanteric fractures with excellent functional outcomes. The DHS comprises a plate and screws applied to the lateral side of the femur (4). From a mechanical point of view, the dynamic hip screw (DHS) is a sliding screw device, which has many advantages such as enhancing Fracture healing as it allows controlled telescoping and impaction of the fracture during weight bearing, with short operation time (7).

However, use of this device in unstable trochanteric fractures has also been reportedly associated with significant medial displacement of the shaft resulting from excessive sliding of screw within the barrel and a higher incidence of screw cut out (8). Moreover, up to 12% of unstable trochanteric fractures show radiological identifiable rotation of the proximal fragment, when fixed with (DHS) alone, as (DHS) provides only single-point fixation over which the proximal fragment can rotate with the movement of hip. This can result in a significant number of non-unions and malunions due to poor bone contact between the two fragments (9).

The intramedullary device, consisting of the Gamma nail with various modifications, is commonly used for unstable intertrochanteric fractures. The Association for Osteosynthesis (AO) organization modified the Gamma nail and developed the proximal femoral nail antirotation (PFNA) device in 2004 to obtain better fixation strength for osteoporotic patients. It has been widely used since that time for almost all types of trochanteric fractures. It is composed of intramedullary nail with proximal angulation of 6° that is available in short and long versions, which can be distally locked with screws which can be static or dynamic. A helical blade that inserts into the femoral head allows compaction of cancellous bone and increase rotational stability (10).

The intramedullary fixation device has theoretical advantage over dynamic hip screw, as it provides more efficient load transfer than does a dynamic hip screw, the shorter lever arm of the intramedullary device can be expected to decrease tensile strain on the implant, so decreasing the risk of implant failure, the intramedullary location limits the amount of sliding and therefore limb shortening and deformity that can occur; the fracture can settle until the proximal fragment abuts against the nail. Finally, insertion of the intramedullary device is a closed procedure which may require a shorter operative time, less bleeding and less soft-tissue dissection (11).

Aim of work:

To make a comparison between Dynamic hip screw (DHS) and Proximal femoral nail (PFN) in the treatment of patients with intertrochanteric regarding the radiological and functional outcome.

Management of trochanteric fracture:

The goal of treatment for patients with intertrochanteric hip fractures should be the early mobilization of the patient, with a prompt return to the prefracture level of functioning. For trochanteric fractures, especially displaced fractures, this goal is rarely achieved without surgical intervention. The early patient mobilization that surgical management offers is a major factor in improved outcome, many advances in medical care also reducing morbidity and mortality (12). Closed nonoperative treatment of intertrochanteric hip fractures has historically been associated with higher morbidity and mortality than operative treatment (13).

- <u>Nonoperative Treatment:</u>

  There are certain relative indications for nonoperative treatment of intertrochanteric fractures. These include:

- Patients with unstable medical conditions that are not controlled.
- Infection at site of fracture and active infectious diseases that preclude insertion of a surgical implant.
- Patient with significant skin breakdown over proposed surgical sites.
- Patients who are in the end-stages of terminal illness with less than 6 weeks of life expected.
- Patients who are non-ambulatory or had little chance to walk again patient with dementia and severe mental disorder (14).

- <u>Operative Treatment:</u>

It is the treatment of choice for the vast majority of intertrochanteric fractures, as it allows early rehabilitation and offers the patient the best chance for functional recovery. The goal of operative treatment is stable fixation of the fracture fragments (14). The factors that determine the strength of the fracture fragment-implant assembly are bone quality, fragment geometry, reduction, implant design, and implant placement. Of these five elements of stable fixation, the surgeon can control only the quality of the reduction and the choice of implant and its placement (15).

Implant Selection:

Two broad categories of internal fixation devices are commonly used for intertrochanteric femoral fractures, sliding compression hip screws with side plate and intramedullary fixation devices. Dynamic hip screw includes traditional compression hip screws that provide compression in the intertrochanteric plane and compression plates that provide additional compression axially. Intramedullary devices include cephalomedullary nails with two screws (e.g. Recon-type nails) or compression-type screws (e.g., the Gamma or Proximal femoral nail) (16).

Dynamic hip screw (DHS):

The DHS system was initially introduced by Clawson in 1964 the system is composed of DHS plate and DHS lag screw. The plates are available with two types of barrels, a standard long barrel (38mm) and a short barrel (25mm). The short barrel plates are seldom indicated; their gliding characteristics are far less satisfactory than those of standard barrel plates. Their use should be limited to especially small femora when a screw length is 85 mm or less (17, 18). The DHS plates also are produced with several barrel angles. The 135○ plate is most commonly utilized. This angle is easier to insert in the desired central position of the femoral head and neck and creates less of a stress riser in the subtrochanteric region although greater angles may offer biomechanical advantage (better gliding characteristics, reduction of bending stresses on tube plate junction) particularly in unstable cases (19). Lag screws are available from 50 mm up to 145 in length. The position of the guide pin is adjusted until it lies in the center of the femoral head and neck in both the AP and lateral planes within 5 to 10 mm of the sub-chondral bone (17, 19).This construct allows telescoping and impaction of the fracture during weight bearing Thereby shortening the lever arm, decreasing the bending moment, and avoiding cut out from the femoral head this enhance fracture healing (20).

Figure (1): Dynamic hip screw (21).

The percutaneous compression plate (PCCP):

The percutaneous compression plate (PCCP) has two smaller-diameter lag screw-barrel components which stabilize the femoral head and neck. This device was designed to be inserted through a minimally invasive surgical technique. Theoretically, these two lag screw components (9.3 mm and 7.0 mm diameters) provide greater rotational stability of the proximal fracture fragment than the single, large-diameter lag screw of a standard sliding hip screw (22).

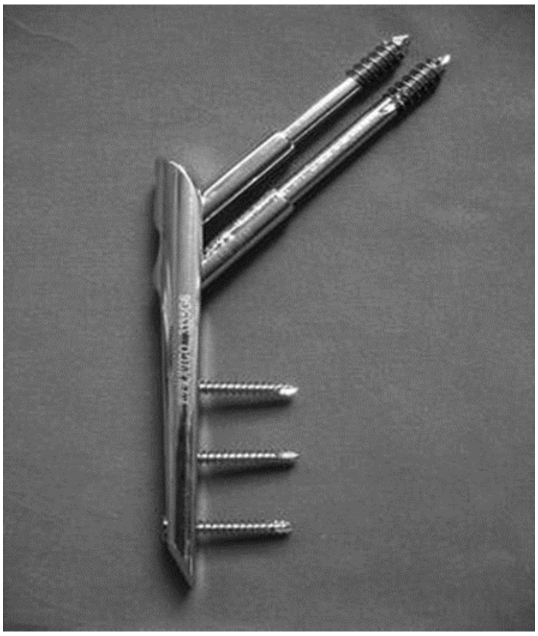

Figure (2): Percutaneous compression plate (23).

The Trochanteric Stabilizing Plate (TSP):

The trochanteric stabilizing plate (TSP) was introduced in the early 1990s as an adjunct to the sliding hip screw. The plate s used for stabilizing unstable fracture patterns by buttressing the lateral trochanteric wall and is intended to prevent medialization of the femoral shaft. These plates are placed over DHS side plate; they also prevent telescoping of the lag screw within the plate barrel when the proximal head and neck fragment borders the lateral buttress plate (24). The lateral buttress plate has holes in the proximal portion of the plate, which can also be used for screw fixation of the greater trochanter or for insertion of an anti-rotation screw into the femoral head. Clinical studies suggest that these lateral support plates are most useful with unstable peritrochanteric fractures with a deficient lateral cortical buttress (24).

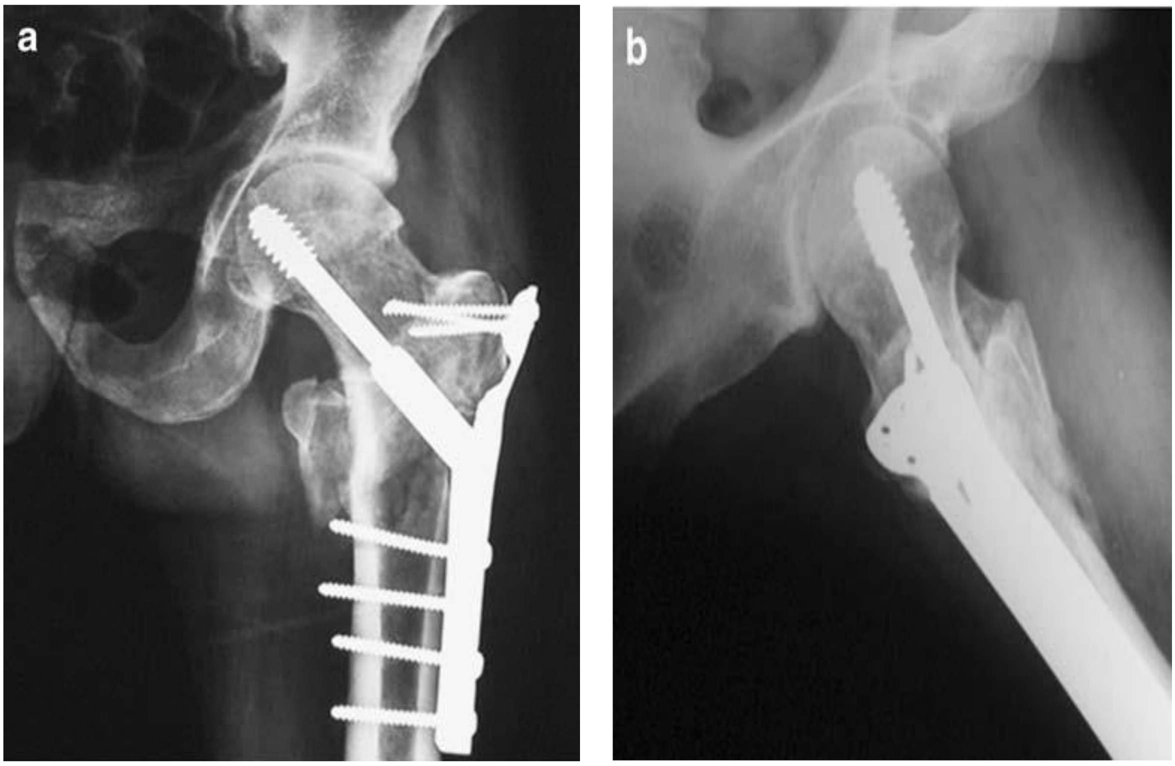

Figure (3): Dynamic hip screw (DHS) supplemented by trochanteric stabilization plate (TSP). an AP views. b Lateral view (24).

Intramedullary devices:

Intramedullary devices have a theoretical advantage over extramedullary devices. This type of design offers several potential advantages:

(a) An intramedullary fixation provides more efficient load transfer than does a dynamic hip screw.

(b) The shorter lever arm of the intramedullary device led to decrease tensile strain on the implant, so decreasing the risk of implant failure.

(c) It is not the reduced lever arm that offers the clinically significant mechanical advantage, but rather the intramedullary buttress that the nail provides to resist excessive fracture collapse (4).

The unstable intertrochanteric fractures the most common indication of intramedullary nailing in this area, the goals and advantages of the intramedullary device nails systems are as follows:

* To provide proximal fixation of the femoral neck by nails or screws.
* To allow the femoral head and neck to collapse and impact the fracture to increase stability.
* To lie within the medullary canal of the femur, thereby decreasing the lever arm on the proximal fragment.
* To allow early full weight bearing (25).

Complications of Treatment of Trochanteric Fractures:

Despite the good results with operative treatment of trochanteric fracture, specific complications can occur that lead to re-operation. Treatment of complications can be a challenge for the surgeon. male sex, old age, comorbidities, and osteoporosis are risks for increased postoperative mortality in trochanteric femoral fractures (26) .

- <u>Intraoperative Complications:</u>

Insufficient reduction may trigger a chain of subsequent complications, starting from incorrect position of the lag screw in the femoral head and leading up to mechanical failure of internal fixation. In unstable pertrochanteric fractures, it is useful to perform valgus reduction in the anteroposterior (AP) projection, especially when the fracture is to be fixed with a dynamic hip screw (DHS) (27).

- <u>Early Postoperative Complications:</u>

Complications occur during surgical wound healing as hematoma, superficial infection, deep infection deep venous thrombosis and pulmonary embolism (26).

- <u>Late Postoperative Complications:</u>

Complications of Fracture Healing may occur as Mechanical failure of internal fixation (Lag screw cutout, subcutaneous lag screw protrusion, intra-articular lag screw protrusion, nails breakage, femoral shaft fracture. Collapse of fragments and medial displacement of the femoral shaft (Femoral Medialization) may also occur. Complications Developing or Persisting after Surgical site or Fracture Healing include Leg length discrepancy, fracture of the femoral shaft, subcapital fracture of the femoral neck, thigh pain, late infection, hip abductor pain or avascular necrosis of femoral head (26).

CONCLUSION AND RECOMMENDATIONS:

We concluded that in stable trochanteric fractures, both the PFN and DHS nearly have similar optimal functional outcomes. Further studies are requested to analyze all aspects of this issue.

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