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Dynamic Hip Screw Versus Proximal Femoral Nail in Treatment of Unstable Intertrochanteric Fracture of Femur AO/OTA Types 31 A2 and 31A3 in Patients above Sixty Years Old. A Comparative Study

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Abstract

Background and objectives: Intertrochanteric fracture of the femur is one of the common and challenging fractures in the orthopedic field, which mostly affect old osteoporotic patients. Different method of fixation used to treat intertrochanteric fracture of femur, including dynamic hip screws and proximal femoral nail .We compared the dynamic hip screw and proximal femoral nail methods of fixation in unstable intertrochanteric fracture of femur (AO Types A2 and A3) with respect to duration of surgery, blood loss, intraoperative complications, union rate and functional return. **Methods:** A prospective randomized and comparative study was conducted on forty two patients, 26 males (61.9%), 16 females (38.1%), from March 2015 to March 2017. Out of 42 cases, 20 patients (47.6%) treated with dynamic hip screw (group A) and 22 patients (52.4%) with proximal femoral nail (group B). In this study, maximum age was 80 years and minimum was 60 years old with a mean age of 70.9 years. **Results:** Our study found that proximal femoral nail fixation had relatively lesser operative time (74.5+2.6 minutes in dynamic hip screw group and 57+2.3 minutes in proximal femoral nail group), less blood loss observed (150±10.7 ml in dynamic hip screw group and 90±6.7 ml in proximal femoral nail group) and the patients were capable of early mobilization and lesser rates of implant failures (2 cases in dynamic hip screw group with no case in proximal femoral nail group), however, dynamic hip screw patients showed faster fracture healing (12-16 weeks in dynamic hip screw group and 16-24 weeks in proximal femoral nail group). **Conclusions:** Proximal femoral nail provides more stable fixation for unstable intertrochanteric fractures specially AO type 31A3 and has more favorable short-term outcomes with a shorter procedure duration, less blood loss and no implant failures.

Keywords: Intertrochanteric fracture; Proximal femoral nail; Dynamic hip screw.

Introduction

Intertrochanteric fractures are defined as fractures involving upper end of femur through and in between both trochanters, greater trochanter in which gluteus medius and minimus inserted (extensor and abductor of hip joint) and lesser trochanter where the iliopsoas tendon attached (flexor of hip joint)[1,2]. Intertrochanteric fractures are the commonest among hip fractures[3]. Peritrochanteric fractures of the proximal femur are very common among the elderly. The incidence of these fractures is predicted to increase even further with increasing age of the population as predicted by Gulberg et al, in which he forestalled that the total number of these fractures will reach 2.6 million by 20253[4].

In Asia, 26% of all hip fractures recorded at 1990 while this percentage could increase to 37% in 2025 and 45% in 2050[2]. With unknown reason, there is ambition that hip fracture has begun to decline in certain areas of world like in Denmark, in which the occurrence of this fracture has declined about 20% from 1997 to 2006[3,4].

Intertrochanteric fracture occurs as a sequel of either high-energy trauma (rare; seen in young male patients) or simple low-energy falls (common; seen in elderly female patients)[5].

A direct impact or a torsional force transmitted through the leg to the intertrochanteric area will lead to a fracture when such forces are greater than the strength of the bone.

The cause of low-energy intertrochanteric fracture is as a result of many factors for example increased bone fragility (osteoporosis), decreased graciousness, and muscle weakness. The increasing bone fragility occurs as a result of osteoporosis and osteomalacia secondary to a paucity of adequate ambulation, as well as diminution in hormone levels, demineralizing hormones increased, lack of proper nutrition (calcium and vitamin D) and aging processes [5].

Benign and malignant lesions, as well as metastases like multiple myeloma and other malignancies, can also cause weakened bony structure.

These fractures associated with high rates of morbidity, loss of independence and even death. The aim of treatment is to get rigid fixation, early mobilization and weight bearing in order to prevent morbidity and to facilitate rehabilitation[6]. The aim behind our study is comparison between dynamic hip screw and proximal femoral nail method of fixation in unstable intertrochanteric fracture of femur (AO/OTA type 31-A2 and type 31-A3) in patients elder than 60 years of age with respect to intra-opera-

tive parameters (duration of surgery, intra operative blood loss) and functional outcome regarding fracture union and functional return.

Materials and methods

A prospective randomized and comparative study was conducted on the patients admitted to Hawler East and West emergency hospitals. Our study population was consisted of 42 patients. 26 males (61.9%), 16 females (38.1%)) from March 2015 to March 2017. 20 patients treated with DHS (group A) and 22 patients were treated with PFN (group B). In this study, maximum age was 80 years and minimum of 60 years with an average of 70.9 years, Table 1.

Inclusion criteria for the patients included in the study were as follows: patients were in the age group of more than 60 years of either sex, intertrochanteric fracture type 31-A2, 31-A3 (AO/OTA classification).

The exclusion criteria were: pathological fractures, compound fractures, associated fractures and medically unfit for surgery.

Table (1): Prefracture variables in 42 patients with intertrochanteric fractures Type A2, A3 treated with dynamic hip screws (DHSs) and proximal femoral nails (PFNs).

Variable	DHSs N=20	PFNs N=22	Total N=42
Age(years)	70.9±2.81	70.9±4.33	70.9±5.76
Gender			
Male	11 (26.2%)	15 (35.7%)	26 (61.9%)
Female	9 (21.4%)	7 (16.7%)	16 (38.1%)
Diabetes	4 (9.5%)	6 (14.3%)	10 (23.8%)
Hypertension	5 (11.9%)	8 (19.1%)	13(31%)
CVA	2 (4.76%)	1 (2.4%)	3 (7.16%)
Fracture type			
31A2	15 (35.7%)	14 (33.4%)	29 (69%)
31A3	5 (11.9%)	8 (19%)	13 (31%)

The important parameters assessed were: operative time, blood loss, infection, post-operative deep venous thrombosis, weight bearing and walking, union (Fracture healing) and screw cut out (implant failure).

All patients were precisely evaluated preoperatively which included detail history and examination. The radiograph of pelvis with both hips was taken, skin traction was applied to all cases (5 Kg applied), medical consultation done for most of the patients, and the patients sent for full investigation including chest X ray, echocardiography, ECG, laboratory tests (hemoglobin level , virology screen, blood sugar, renal function tests), and blood prepared for all of them. An antibiotic (1 gram Ceftriaxone) was given to the patients about 30 minutes before the surgery and operation done within 24-72 hours.

For the operative procedures in DHS, the followings done: Under anesthesia [(general 6 cases), (spinal 14 cases)], supine position, the patients were positioned on a well-padded orthopedic table, the non- fractured leg was carefully put on flexion and external rotation. Closed reduction for the fracture was achieved under fluoroscopy and clinically as well (i.e. no shortening, no rotation, neck-shaft angle about 135oand preferably in slight valgus while varus position was contraindicated), maintenance for the reduction was kept by the orthopedic table. Through a lateral incision below the greater trochanter, vastus lateralis fascia and muscle incised longitudinally. Under fluoroscopic control the guide wire was inserted about 1 to 2 cm below the vastus ridge by using the angle guide (135o) and checked by AP and Lateral views (i.e. the guide wire in the femoral neck was in central position on AP view or anterior and inferior on lateral view) till the wire reached to about 5 mm subchondrally to the joint line, after reaming, the length of compression screw is measured on AP and Lateral views. After screw insertion the guide wire was removed, the length of side plate is determined to allow purchase of at least 6 cortices to the shaft distal to the fracture. After the side plate was putted, then the traction on the fracture site is decreased to allow impaction of the fracture site then the shaft cortical screws put and secured also the compression screw. The wound closed in layers over secured drain.

For the operative procedures in PFN, the followings done: The patients were put on well-padded orthopedic table (supine position) and the unfractured leg put on a leg support in flexion and external rotation position. Under anesthesia (general 9 cases, spinal 13 cases), in all cases closed reduction done for the fracture clinically and this anatomical reduced position of the fracture maintained and kept by continuous traction on the orthopedic table. An incision done about 2 to 3 cm proximal to the greater trochanter, the entry point identified at the medial aspect of the tip of greater trochanter, Awl is used to make the entry point and guide wire was inserted down to the shaft. Reaming done in most of the cases. Under fluoroscopic guide, nail diameter was dictated by measuring diameter on AP X-ray. After that a suitable sized nail was inserted. After inserting the proximal screws in the femoral neck, the traction on the fracture site was decreased. This was followed by insertion of the distal screw. Drain was not used in any cases. The wound was closed.

Postoperatively most of our patient had been admitted to the intensive care unit to ensure good monitoring for these elderly patients .The antibiotics (Ceftriaxone vial 1g twice daily intravenously) which is started about 30 minute from skin incision After performing allergy test was continued for 3 days then changed to oral antibiotic (400 mg cefixime capsule once daily) for another 5 days. Thromboprophylaxxis in form of Clexane (enoxaparin) vial 4000 I.U subcutaneously given to all patients 6 hours after the operation and continued for two weeks. All patients were treated with physical methods such as early mobilization, manual compression of the calf and elastic stockings. Patients were encouraged for sitting, ankle and calf exercises from day one. Mobilization of the patient and weight bearing exercise were done by support from at the second postoperative day depending upon the physical condition

of the patient.
The wounds were checked on the 3rd and 6th post-operative day. Stitches were removed after 2 weeks from the surgery.
The two groups were compared using the t test or the Student's t-distribution . SPSS-20 software will be used for data analysis. A P value of <0.05 was considered extremely statistically significant.

Results

This study involved 42 cases of intertrochanteric fractures (26 males (61.9%), 16 females (38.1%). Out of 42 cases, 20 patients treated with DHS (group A) and 22 patients were treated with PFN (group B). In this study, maximum age was 80 years and minimum of 60 years with an average of 70.9 years, Figure 1, 2.
In Group A we checked 20 patients (47.6%), 11 were males (26.2%) and 9 were females (21.4%) whileln group B 22 patients (52.4%) were included in which 15 were males (35.7%) and 7 females (16.7%).
In-group A 15 patients had A2 fracture AO Type (35.7%) and 5 patients (11.9%) had A3 fracture AO Type, in-group B 14 patients were had A2 fracture AO type (33.3%) and 8 patients with A3 fracture AO type (19%).

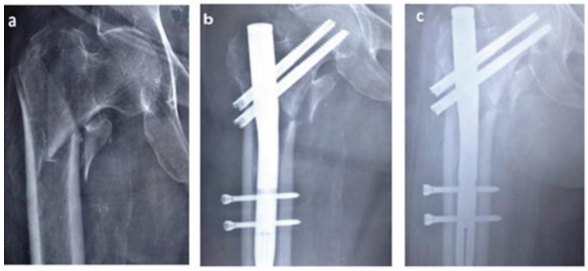

Figure (1): 68 years old male with right intertrochanteric fracture of femur (31A3) (a) Preoperative anteroposterior view. (b) Immediate postoperative anteroposterior view. (c) Anteroposterior view at 6 weeks follow up.

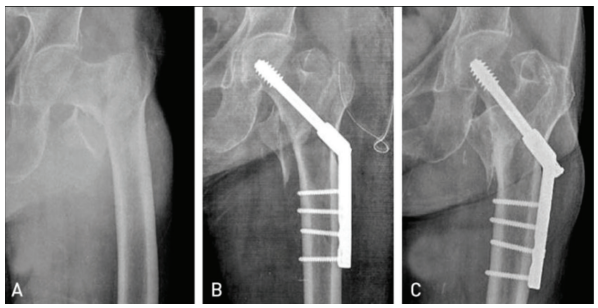

Figure (2): 65 Year-old male patient with left intertrochanteric fracture (31A2) fixed with DHS (A) Preoperative anteroposterior view (B) Immediate post-operative anteroposterior view (C) Anteroposterior view at 12 weeks follow up.

The time was calculated from the time of skin incision to the time of skin closure, the average procedure duration for the group A was 74.5+2.6 minutes and for the group B the average was 57+2.3 minutes, Table 2.

Table (2): Intraoperative and early postoperative variables in 42 patients with intertrochanteric fractures.

Variable	DHSs N=20	PFNs N=22	Total N=42
Operation time (min)*	74.5±2.6	57±2.3	65.3±2.2
Blood loss (ml)*	150±10.7	90±6.7	120±8.7
Pulmonary embolism	0 (0 %)	0 (0 %)	0 (0 %)
Wound discharge	0 (0 %)	0 (0 %)	0 (0 %)
Full weight bearing 1st day postoperatively*	10 (23.8%)	22 (52.4%)	32 (76.2%)
Standing and walking 2nd day postoperatively	12 (28.6%)	22 (52.4%)	34 (81%)

*P<0.05

Estimated blood loss was measured by checking the amount of blood in the suction container as well as the blood stained swabs., it was less in group B compared to group A with an average loss of 150±10.7 ml in group A and 90±6.7 ml in group B, Table 2 and Figure 3.

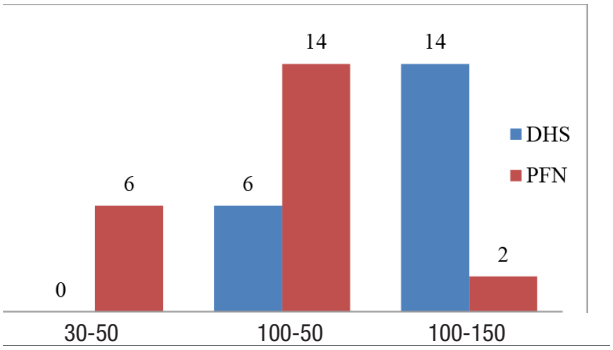

Figure (3): Distribution of samples according to the amount of blood loss (ml)

In group A, 1 patient out of 20 had implant failure in the form of cut-out and 1 patient with broken screw. These two cases required revision surgery. In group B there were no implant failures, Table 3 and Figure 4.
Infection:
There were no any cases of infection in both groups.
Postoperative DVT:
There was no record of any postoperative DVT or pulmonary emboli.

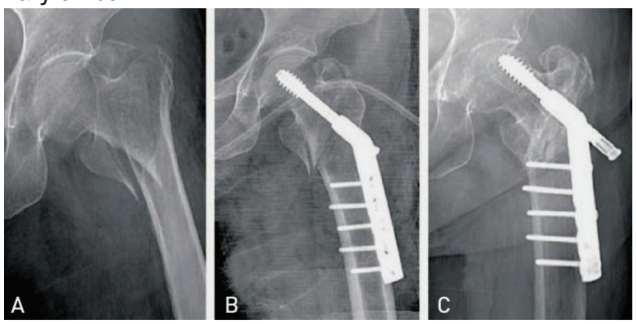

Figure (4): (A) Anteroposterior view of 75 years old female patient with intertrochanteric fracture (31-A3). (B) Immediate post-operative anteroposterior view which fixed with DHS.
(C) Anteroposterior view at 12 week follow up (failure) cut out.
Regarding the weight bearing first postoperative day, in

group A, 10 patients out of 20 were able to bear weight in the first postoperative day follow up, all of whom were from A2 type of fracture. None of the A3 fracture type patient (5 cases) was able to do so. In contrast, in group B all the 22 patients were able to do full weight bearing in the first post-operative day, Table 2.

Weight bearing and walking was done using walking aid in the second postoperative day, in group A 12 patients (29.8%) were able to walk with assistance, in these 12 patients 11 were from the A2 fracture type and only 1 from the A3 fracture type. In group B all the patients were able to walk with aid, Table 2.

Regarding the time to return to previous activity, in group A, the period to return to pre-fracture activity was 12-16 weeks, while in group B was 6-8 weeks (significantly shorter).

The union rate was faster in the group A with an average of 12-16 weeks compared to an average of 16-24 weeks in the group B, probably DHS fixation to bone apply more compression than PFN, Table 3.

Regarding Functional hip score, all patients subjected to the Harris hip score at the 6 weeks, 12 weeks, 24 weeks and one year follow up. In the group A, the 6 weeks hip score was less than that of the group B (average for DHS was 24 and for PFN was 30), P value <0.05. On 24 weeks and one year follow up, the differences were greatly decreased between the groups (average for DHS was 68.5+5 and for PFN 68.7+5). At one year, the score for both being the same (score=96), Figure 5 and Table 3.

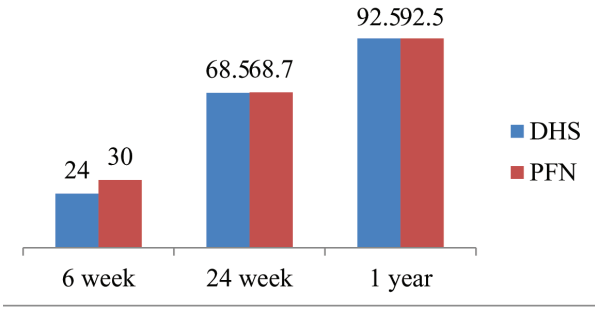

Figure (5): Distribution of samples according to Harris Hip Score

Table (3): Complications and functional outcomes of 2 years follow-up of 42 patients with intertrochanteric fractures Type A2 and A3 treated with dynamic hip screws (DHSs) and proximal femoral nails (PFNs).

Variable	DHSs N=20	PFNs N=22	Total N=42
Cut out*	1 (2.4%)	0 (0%)	1 (2.4%)
Plate/Screw failure*	1 (2.4%)	0 (0%)	1 (2.4%)
Union rate(weeks)*	14.4±1.3	19.8±2.6	17.2±3.4
Harris Hip Score:			
12 weeks	15.4±2.9	29±5.5	22.5±8
24 weeks	68.5±5	68.7±5	68.6±5
1 year	92.5±1.3	92.5±1.5	92.5±1.4
Time to return to previous activity (weeks)*	14±1.5	7±0.8	10.4±3.8

*P<0.05

Discussion

In the last few decades treatment of intertrochanteric fractures has evolved significantly. The treatment depends on the fracture type and quality of bone[7]. Dynamic hip screws has been contemplated the gold standard of intertrochanteric fracture fixation for a long time[8,9]. Although DHS allow compression of the fracture site; it is relatively contraindicated in the elderly with comorbidities due to protracted surgical dissection, blood loss and the time required for this procedure[10-13]. Dynamic hip screws device is placed away from mechanical axis of proximal femur so the moment arm is more in these devices, so tensile stress is more & they behave as load sharing device, so integrity of medial cortical buttress is required for fixation of DHS device. Proximal femoral nail device is placed close to mechanical axis of femur so moment arm is less in them leading to less tensile stress, thus they act as load bearing devices[13,14]. In this study, we observed that both PFN and DHS were effective in treating unstable intertrochanteric femur fractures but PFN is superior to DHS in terms of relatively less operative time, less operative blood loss, shorter time to full weight-bearing, early return to daily activities, less complications and implant failure, considered to be like minimum invasive surgery (MIS).

The parameters in our study revealed results similar to that of Ujjal Bhakat , Ranadeb Bandyopadhayay study which was conducted in 2013[15] .He had selected 60 patients with unstable intertrochanteric fracture of femur, 30 of them were treated with DHS and 30 cases with PFN. In his study, he found that the operative time for the PFN group (48.73 min) was significantly shorter than the DHS group (69.03 min), which is similar to our study result. Also the result of the amount of blood loss in his study is similar to our result; lesser in PFN group (averagely 116 ml) compared to DHS group averagely about 200 ml). Regarding the implant failure, one of his cases which were treated with DHS suffered screw cut out and other one end with screw breakage, and in PFN group, one case showed screw backout. Our study corroborated with that of Baumgaertner et al[16] who discovered the surgery duration to be 10% higher and a mean 150 ml more of a blood loss in DHS group. Similar observations have been proclaimed by many antecedent studies[17, 18].

In our study, in the DHS group, the sliding screws cut-out in one patient despite adequate initial reduction and implant position as opposed to none in the PFN group. In this case the fracture was an unstable one. Former studies have enunciated varus collapse and failure of femoral head screw to be a constant complication with DHS[19, 20]. Functionally, utilizing the Harris hip scoring system, at the early follow-up, our study affirms PFN to be superior to DHS but at final follow-up functional results is same. This outcome was authenticated by Bhakat et al[15], who pronounced parallel results implementing same score.

So our study results showed that the PFN appeared to be superior to DHS in management of unstable intertro-

chanteric fracture of femur. Early stabilization of unstable intertrochanteric fractures with mechanically more stable implants (such as the PFN) enables earlier weight bearing, recovery of ambulatory function, as well as less reliance on care-givers.

Conclusions

Proximal femoral nail provides more stable fixation for unstable intertrochanteric fractures specially AO type A3 and has more favorable outcomes in the form of short procedure duration, less blood loss, no implant failures, early mobilization and enhancing early walking ability.

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