Dynamic Hip Screw Versus Proximal Femoral Nail in the Treatment of Stable Intertrochanteric Fractures

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ABSTRACT:

BACKGROUND:

Intertrochanteric fracture is a common injury among older age group , it occupy a high percentage of fragility fractures admitted to the casualty department , lots of methods have been used over decades. Dynamic hip screw (DHS) was the gold standard technique since its invention, however after introduction of the proximal femoral nail (PFN) to the markets in the 90s, this represented a major turning point in the management of intertrochanteric fracture especially the unstable ones.

OBJECTIVE:

To compare the results of DHS versus PFN in the management of stable intertrochanteric fractures.

PATIENTS AND METHODS:

Prospective study included 35 patients who underwent operation by either DHS or PFN, all patients sustained stable intertrochanteric fracture and operated within one week. Closed reduction was done in all patients, PFN cases were done through small incisions under fluoroscope guidance, while DHS cases were operated through standard lateral approach. Patients were assessed according to intraoperative parameters of blood loss, duration of surgery and postoperative parameters regarding partial and full weight bearing, amount of shortening in mm, rate of union, functional score using palmar and proud score , rate of infection and implant complication.

RESULTS:

Significant differences were noted regarding blood loss and weight bearing in favor of PFN, while duration of surgery was less in DHS. No significant differences were noted regarding other parameters.

CONCLUSION:

The study revealed significant difference in favor PFN regarding blood loss, weight bearing and shortening.

KEY WORDS: DHS, PFN, Closed reduction, Intertrochanteric Fracture.

INTRODUCTION:

Treatment of intertrochanteric fracture has been evolving throughout the years. DHS which was the gold standard method of fixation and have been overcome by PFN in 90s. [1]

There are difference between these two methods of fixation in many aspects including biomechanics, demand of the surgical technique, and consequently the results. The most important issue is to identify the stability of the fracture. Evans utilized the presence of posteromedial comminution to differentiate between the stable and unstable fractures, as loss of this buttress will increase the rate of screw cut out and subsequently failure of fixation. [2,3]

The PFN show obvious biomechanical advantage through creating a first lever arm order in contrary to the DHS which has 3rd lever arm order thereby increasing the risk of cutout especially in an osteoporotic bone of the geriatric patients who are the usual victims of intertrochanteric fracture. Furthermore PFN withhold excessive sliding that occur in DHS.[4,5] Thus lots of studies showed that PFN is beyond doubt have better results than DHS in dealing with unstable Intertrochanteric fractures.[6,7,8]

PATIENTS AND METHODS:

This prospective study was done between 1st. of December 2014 and 1st. of August 2015, 35 patients (22 male and 9 females) all above age of 50 years were enrolled in this study with a mean age of 66.6±8.7 SD, all the patients sustained a

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mild domestic trauma with a closed stable intertrochanteric fractures (depending on the absence of posteromedial comminution).

Patients were randomly distributed into two groups;

Group A (N.20), with 12 right sided and 8 left sided fractures and a mean age of 66.5±8.9 SD (50-79 years), they were 13 males and 7 females all were treated by DHS.

Group B (N.15), with 8 right sided and 7 left sided fractures and mean age of 66.6±8.6 S.D (52-80 years), 9 males and 6 females who were treated by PFN.

After optimizing patients' medical condition surgeries were done under spinal anesthesia, closed reduction under fluoroscopic guidance was done in all cases. For group A fixation by DHS was done through lateral approach splitting the vastus lateralis and a guide wire was inserted 1 to 2 cm below the vastus ridge and assessed by fluoroscopy. The femoral anteversion was estimated by advancing a free guide pin by hand up the anterior femoral neck and securing it in the anterior aspect of the femoral head. We placed the guide pin within 5 mm in the subchondral region of the joint line based on AP and Lateral views. Triple reamer was advanced under fluoroscope guidance after which sizing was done. Screw was inserted over the guide-wire for proper insertion. Then the plate was inserted.

Regarding PFN, we started by 3 cm incision about 3 cm proximal to the greater trochanter; it was liable to extension according to body built. Awl was used to create the above entry point, and guide pin was inserted down to the shaft of femur just below the tip of the greater trochanter**.** 10 mm diameter nail and 240 mm length were used. After reaching the intended level, AP and lateral views were taken to assess the alignment then the guide pin removed. Distal locking screw was instead through small incisions with the appropriate sleeve. Per-operative blood loss was calculated through suction drain and mops used. Meanwhile the duration of surgery was calculated as well.

The standard post-operative protocol was applied regarding antibiotics, anticoagulants and physiotherapy started in the second post-operative day. Follow up done during series of visit after patient discharge and the studied parameters were assessed accordingly including Partial and full weight bearing and shortening on subsequent visits.

Radiological assessment done on regular basis for assessment of signs of union depending on the bridging of three out of four cortices and the gap at the fracture site. We traced failure of implant and the screw complications like cut out and screw back out, and at the time possible infection was traced as well, figure (1and2).

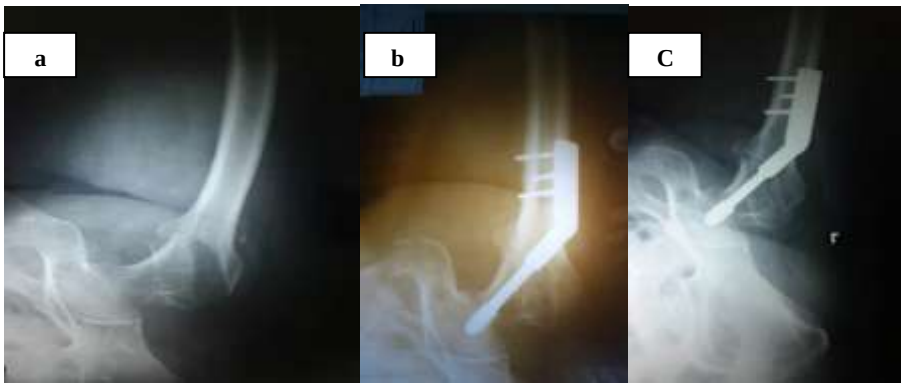

Figure 1; pre and post-operative radiographs of one of the patients who underwent DHS fixation;
a, pre-operative.
b, immediate post-operative.
c, one month pos-toperative
d,e,f, three months postoperative showing bridging callus on AP and lat. views.

Figure 2; pre and post-operative radiographs of one of the patients who underwent PFN fixation;
a, pre-operative.
b, immediate post-operative.
c, one month pos-toperative
d, three months postoperative showing bridging callusand screw backout.

The assessment of the final functional outcome was done by using Palmar and Proud Score, which is composed of 9 points mainly depending on the patient walking ability, as being shown in table (1).

The mean duration of our patients follow up was calculated and found to be 6 months.

Table 1:Palmar and proud score for functional outcome. [9]

Walking Ability	No Difficulty	Alone with an Assistive Device	With Help from another Person	Not at All
Able to walk inside house	3	2	1	0
Able to walk outside house	3	2	1	0
Able to go shopping ,to a restaurant, or visit family	3	2	1	0

RESULTS:

A total of thirty five patients with mean age of 66.6±8.7 SD were enrolled in this study, the mean age of the patients treated with proximal femoral nail method was 66.6±8.6 S.D while those treated with dynamic hip screw method was 66.5±8.9 SD. There was no statistically significant difference regarding the age of both groups table (2).

Table 2: Mean age of the patients.

	Age(years)					P-value
Type of surgery	No.	Minimum	Maximum	Mean	SD	
PFN	15	52	80	66.6	8.6	0.7
DHS	20	50	79	66.5	8.9	

With regard to the gender of the patients, for the PFN group, males represented 60% and females represented 40% of the patients, while for the DHS group males represented 65% and females represented 35% of the patients , statistical analyses revealed no significant difference regarding the gender in both groups (P=0.5).

The assessment of the mean of operation time for the studied groups showed significant difference between the two groups (P=0.04), where the patients operated on with DHS method took less time (87 min±18.5 SD) than PFN method (104.7±33 SD) as seen in table(3) and figure (3).

Table 3:Mean operation time.

	Type of surgery	No.	Mean(min)	SD	P- value
Time of surgery	PFN	15	104.7	33.672	0.04*
	DHS	20	87.00	18.595	

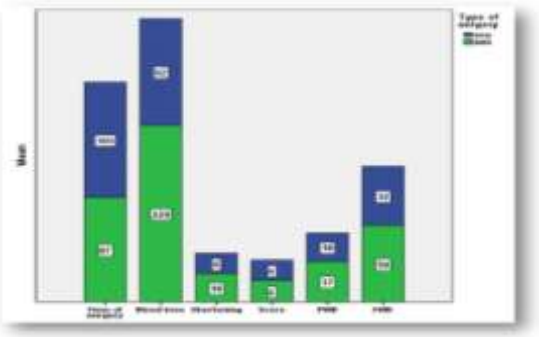

Figure 3: Comparison parameters measured between DHS and PFN

There was a statistically significant difference in mean calculated blood loss between the two groups (P=0.001), where the result showed that the blood loss was significantly more with DHS method in comparison to PFN method (228.7±83.7 ML, 91.7±28 ML) respectively as seen in table (4) and figure (3).

Table 4: Mean blood loss during surgery.

	Type of surgery	No.	Mean/ml	SD	P-value
Blood loss	PFN	15	91.7	28.0	0.001*
	DHS	20	228.7	83.7	

The findings of present study revealed a statistically significant difference with regard to postoperative shortening (P=0.002), as the patients operated on with PFN methods reported less shortening (6 mm±1.8 SD) in comparison to those treated by DHS method (9.6 mm±3.7SD) as seen in table (5) and figure (3).

Table 5: Mean postoperative shortening.

	Type of surgery	No.	Mean/mm	SD	P-value
Shortening	PFN	15	6.0	1.8	0.002*
	DHS	20	9.6	3.7	

Regarding the functional outcome according to Palmar and Proud score there was no statistically significant difference (P=0.2), still the PFN group scored relatively higher mean score of 6.3 out of 9, figure (3).

Significant statistical difference was identified with regards to the partial weight bearing (PWB), (P=0001), where the group of PFN surgery showed mobility with a walking frame earlier than patients underwent DHS surgery, as the PFN group reported mean time of 9.8 days while the DHS group reported 17.1 days, figure (3).

The results of our study demonstrated that the patients underwent surgery with PFN reported earlier full weight bearing (FWB) than those operated with DHS method, where the group of PFN got mean FWB within 31.6±14.3SD days in comparison to DHS group who got mean FWB within 50.1±8.1SD days and this difference was statistically significant (P=0.001), table (6) and figure (3).

Table 6: Mean post-operative full weigh bearing (FWB).

	Type of surgery	No.	Mean/days	SD	P-value
FWB	PFN	15	31.6	14.3	0.001*
	DHS	20	50.1	8.1	

Despite our short term follow up, we were able to assess the rate of fracture union, where 66.7% of patients treated with PFN achieved union within three months in comparison with 60% of those treated with DHS. Still the remaining 33.3% of cases treated with PFN achieved union within six months likewise the remaining 40% of cases treated with DHS also united within six months, no significant statistical difference was reported (P=0.4).

Regarding complications from fifteen patients treated with PFN method, one presented with superficial infection and one with screw back out, this represented about 6.7% of all cases, on the other hand for the patients treated with DHS one presented with superficial infection and one with deep infection, and this represented only 5% of cases. No significant difference was identified, table (7).

Table 7: Post-operative complications.

	Type of surgery	No.	infection	P-value	Implant failure	P-value
Time of surgery	PFN	15	1= 6.7%	0.8	1	0.7
	DHS	20	2= 5%		0	

DISCUSSION:

This study was designed to compare PFN which is more expensive and more technically demanding technique in treatment of stable Intertrochanteric fracture, versus DHS which is a reliable, relatively cheap and technically more forgiving than PFN.

Sridhar and Neelakrishman (2014) [10] studied 42 patient with intertrochanteric fracture treated by different methods of fixation , the study showed that male were more prone to sustain intertrochanteric fracture and they attribute it to the fact that male Indians were more active and

more mobile than females who are confined to house hold activities[10] ,Those observations are more towards our findings. On the other hand Cleveland et al showed that female are more prone to Intertrochanteric fractures, and the study attributed these observations to the fact that they have wider pelvis with tendency to coxa vara, and they are more prone to senile osteoporosis.(11)

At the time where many studies showed longer duration of surgery for DHS[12], this study revealed that PFN took more time than DHS; this was attributed to the fact that PFN is a new modality of treatment in our locality and this is to be associated with a long learning curve.

The per-operative blood loss in our series was significantly less with the PFN mostly because of the close operative technique which requires a small incision and a limited split in the abductor musculature , as compared with the DHS that needed a much longer incision and elevation of the vastus lateralis. Similar results seen in a study done by Khan et al (2004)(13) and different other authors.

Partial and full weight bearing was earlier in patient who underwent fixation by PFN, this fact was always defended by different authors as the entry point in PFN is through a small incision with limited abductor stripping unlike DHS surgery which needs larger incision and more stripping of muscles and soft tissue.(14,15) In addition the PFN is mechanically more stable than DHS as it creates shorter lever arm which translates to a lower bending moment and a decreased rate of mechanical failure. What's more is that the closed reduction with PFN with preservation of hematoma has positive consequences on the consolidation process and early weight bearing.(16)

Pajarenin et al (2005), studied 108 patients of pertrochanteric fractures treated with DHS and PFN, they found that PFN allowed faster restoration of post-operative walking ability when compared with DHS.(6) Earlier union in PFN which was attributed to the different factors, though not significant in stable fractures, it seems to be more obvious in comparing the fixation of unstable fractures.(7)

Functional score did not show significant difference in our study, but other studies which included unstable fractures revealed significant differences. Of those studies the one done by Bhakat et al (2013) which also revealed that this difference is less obvious after one year.(17)

For other complication there was no statically significant difference. But it's worthy to mention that the higher incidence of screw back outs after PFN due to poor hold of the lag screw which was not as good as in DHS. This has been illustrated by Kuang et al 2010, as it may be due to the fact that, in PFN, we ream the whole tract with the same diameter of the drill, while in DHS, we use a graded drill, the (triple reamer), with lesser diameter in its distal portion and greater diameter in proximal portion. This gives a better hold of the lag screw of the DHS and also better compression at the fracture site.(18)

Limb shortening was noticed to be less in patients underwent PFN this may be due to the fact that DHS allow more sliding thus causes impaction at the fracture site with more shortening. Kyle et al explained that the barrel length of DHS is a causative factor of initiating sliding , the longer the barrel the less force required to initiate sliding , while the nail in the medullary canal represents a physical block to significant shortening of head and neck segments in the fractures.(19)

CONCLUSION:

Our study showed that PFN proved to be better on a short term follow up mainly regarding blood loss, shortening and earlier weight bearing.

The duration of surgery was longer for PFN, but this was attributed to the long learning curve for a new modality, and we expect some improvement with time making the PFN a better treatment choice for stable intertrochanteric fractures.

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