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Comparative study between dynamic hip screw and plate with proximal femoral nailing in trochanteric fractures of femur

M. K. Nizamoddin Khateeb*, Satish Babu D. G.

Department Of Orthopaedics, ESIC Medical College, Kalaburagi, Karnataka, India

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***Correspondence:**
Dr. M. K. Nizamoddin Khateeb,
E-mail: nizam.in4u@gmail.com

ABSTRACT

Background: Incidence of intertrochanteric fractures has increased significantly during recent years and it will probably continue to rise in near future due to increased longevity of life. Closed methods of treatment for intertrochanteric fractures have increased mortality rates & have largely been abandoned. Rigid internal fixation and early mobilization has been the standard protocol of treatment nowadays. This study was intended to compare the results of Intertrochanteric fractures treated by dynamic hip screw (DHS) over proximal femoral nailing (PFN).
Methods: This is a randomized prospective study of 102 cases of intertrochanteric fractures, admitted to Mysore Medical College & Hospital, Mysore and ESIC medical college and hospital Kalaburagi and Kamareddy Ortho & Trauma care Hospital Kalaburagi; treated with proximal femoral nailing and DHS. The patients were divided randomly into two groups, each of 51 patients, 51 were treated by Dynamic Hip Screw & 51 were treated with proximal femoral nail (PFN).All patients were followed up for one year.
Results: In our series of 102 patients of Intertrochanteric fractures, 51 were treated with sliding hip screw with plate and 51 were treated by an intra-medullary hip screw. Most of the patients were between 51 to 80 years. Slip and trivial fall accounted for 70% cases. Right side was more common accounted for 58.34% of cases.
Conclusions: From our study, we consider PFN as better alternative to DHS in more unstable fractures with technically difficulty and require more experience. Sliding hip screw remains the implant of choice for stable type fractures. We noticed less operative time, less blood loss, fewer intra-op complications in PFN group. The quality of the reduction achieved & proper positioning of the implant are important to achieve the best post-operative outcome.

Keywords: Inter-trochanteric fractures, Dynamic hip screw, Proximal femoral nail

INTRODUCTION

Inter-trochanteric fractures account for approximately half of the hip fractures in elderly; out of this, more than 50% fractures are unstable.[1,2]

They are classified According to AO/OTA classification as A1 fractures are simple, two-part fractures, A2 fractures have multiple fragments and A3 fractures includes reverse oblique and transverse fracture patterns.[3]

These fractures unite readily with conservative line of treatment but there is fear of complications like, malunion, shortening, and osteoarthritis of hip joint. Earlier active treatment was usually delayed for 3 to 4 weeks which lead to secondary complications.

They primarily involve cortical and compact cancellous bone. Because of the complex stress configuration in this region and its nonhomogeneous osseous structure and geometry, fractures occur along the path of least resistance through the proximal femur.[4]

The various treatment options for intertrochanteric fractures are operative and non-operative. The non-operative method was used to be a treatment of choice in early 19th century when the operative technique was not evolved enough to do stable fixation. Non-operative treatment should only be considered in non-ambulatory or chronic dementia patients with pain that is controllable with analgesics and rest, terminal diseases with less than 6 weeks of life expectancy, unresolved medical comorbidities that preclude surgical treatment, active infectious disease that itself is a contraindication for insertion of a surgical implant. The goal of treatment of any intertrochanteric fracture is to restore mobility safely and efficiently while minimizing the risk of medical complications and restore the patient to pre-operative status.

The dynamic hip screw (DHS) has gained widespread acceptance and is currently considered as one of the most primary options and the standard device for comparison of outcomes for stable or minimally displaced peritrochanteric fractures. The DHS has been shown to produce good results but complications are frequent, particularly in unstable inter-trochanteric fracture. However, in unstable fractures, the DHS device performs less well with a relatively higher incidence of internal fixation failure.[5] The advantages of PFN is that it serves as a buttress against lateral translation of the proximal fragment. The intramedullary location of the junction between the nail and lag screw makes the implant stronger at resisting the binding force.[6] The intramedullary device has a reduced distance between the weight bearing axis and the implant that is a shorter lever arm. An intramedullary device bears the bending load which is transferred to the intramedullary nail and is resisted by its contact against the medullary canal (load sharing device). The intramedullary hip screw is a more biological method of fixation.[7]

The aim of our study was to compare the result of treatment of these fractures by either of these two methods i.e. proximal femoral nailing and dynamic hip screw.

METHODS

A prospective randomized and comparative study was conducted on the patients admitted in the Department of Orthopedics Mysore Medical College and Hospital, Mysore and ESIC medical college and hospital Kalaburagi and Kamareddy Ortho and Trauma care Hospital Kalaburagi. Our study population mainly consisted of 102 patients (51 in each group) with more than 50 years of age. The study period was about six years from May 2011 to September 2016. Eligibility criteria for the patients included in the study were as follows 1) patients who were in the age group of more than 50 years of either sex, 2) intertrochanteric fracture type 31-A1, A2, and A3 (OTA classification) without any systemic or psychiatric illness, 3) patients who were fit for anaesthesia.

The exclusion criteria were 1) patients unfit for the surgery, 2) compound or pathological fractures, 3) those admitted for re-operation, 4) patients who had less than 2 years of follow-up, 5) fractures associated with polytrauma, 6) pre-existing femoral deformity and 7) those who have not given written consent for surgery. After obtaining ethical clearance from the institutional Ethical committee, study was conducted among the patients after obtaining written informed consent. The relevant information collected from all patients including history, general and systemic examination findings. Initial radiograph of the hip joint was taken besides routine pre anesthetic investigations. The 102 patients were divided into two groups, 51 in each. The patients under group A were treated by proximal femoral nailing and patient under group B were treated by Dynamic hip screw (Figure 1).

Figure 1: Pre and postoperative x-rays of DHS and PFN.

Table 1: Harris hip score.

Parameters	Grading
Pain	< 70 points Poor
Limp	70-79 points Fair
Distance walked	80-89 points Good
Support	90-100 points Excellent
Sitting	
Enter public transportation	
Stairs	
Put on shoes and socks	
Absence of deformity	
Range of motion	

The decision for the type of the operation was based on surgeon's preference and availability of the implant. Prior to hip surgery, each patient was evaluated. The overall time from injury to surgery averaged 3.2 days (range: 1–6 days). All surgeries were performed on the traction table following closed reduction confirmed with fluoroscopy on two different planes. All patients in our study were treated with physical methods such as early mobilization, manual compression of the calf and elastic stockings.

Patients were encouraged ankle and calf exercises from day one and mobilized non-weight bearing from the second post-operative day depending upon the physical condition of the patient. All drains were removed by 24 h. The wounds were inspected on the 3rd and 6th postoperative day. Stitches were removed on the 12th day. Patients were followed up at one monthly interval till fracture union and then at 6 monthly interval for 1 year and then at yearly interval. The clinical outcome for each group was analyzed, and intraoperative, early (within first month after hip fracture repair), and late complications (after first month) were recorded. Their functional outcome was assessed with Harris Hip Scores (Table 1).

Statistical analysis

The t test for independent samples was used to compare the 2 groups for age, sex, fracture pattern, duration of surgery, length of incision, average blood loss, and intraoperative complications. The Fisher exact test and unpaired t test were used to calculate and compare the groups. A comparison of intra-operative complication rates revealed no statistically significant differences between study groups.

For all analyses, a P >0.05 was considered significant. Statistical analyses were performed using SPSS 24.0 (SPSS Inc, Chicago, Ill).

RESULTS

The average age was 65.2 years. In both groups 21 were male and 30 were female patients. In PFN group, 7 were OTA 31-A1, 8 were OTA 31-A2 and 26 were 31- A3. In DHS group, 27 were OTA 31-A1, 15 were OTA 31-A2 and 8 were 31- A3 (Table 2).The results were statistically analyzed and the two tailed p values were evaluated.

Table 2: Study groups.

Study group	Sex M/F	Age (mean)	Fracture pattern		
			A1	A2	A3
PFN	21/30	65.2	7	8	26
DHS			27	15	8

According to AO/OTA classification; A1 fractures are simple, two-part fractures; A2 fractures have multiple fragments; A3 fractures includes reverse oblique and transverse fracture patterns.

The average duration of surgery for the PFN 48 minutes was significantly shorter then DHS 70 minutes, p <0.0001. The average blood loss in the PFN group was 120 ml and in DHS group was 250 ml, blood loss is less in PFN which is statistically significant, p value <0.0001. Average incision size for DHS was 6 cm while for PFN group was 3 cm. Patients with excellent results were 20 (37.5%) in DHS group and 34 (66.2%) in PFN group, patients with good results are 26 (54.1%) in DHS group and 15 (28.2%) in PFN group, patients with fair results are 4 (6.6%) in DHS group and 2 (5%) in PFN group and patients poor results were 1 1.6%) in DHS group and no patient with poor results in PFN group (Figure 2).

Figure 2: Operative steps of DHS and PFN.

Table 3: Overall complications.

Complications	PFN	DHS
Superficial infections	0	2
Nonunion	1	1
Implant failure	2	2
Deep infection	0	1

Figure 3: PFN-screw backout with fracture nonunion.

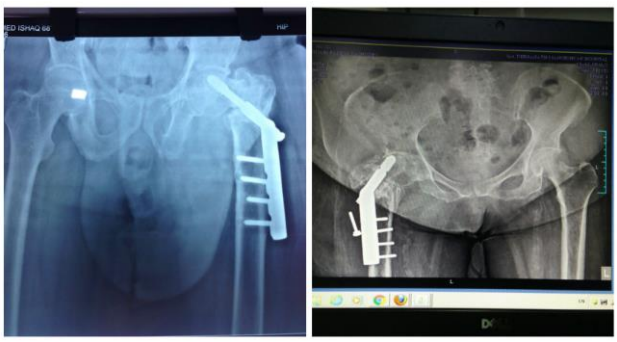

Figure 4: DHS-implant failure.

There were 3 cases of infection seen in the DHS group (Table 3) and were treated by local debridement and antibiotic and did not require implant removal. 1 which was acquired late required implant removal and was managed conservatively. No infection was seen in PFN

group. 2 case of implant failure in PFN group and revision surgery was required for it (Figure 3). The usual 'Z' pattern of implant failure was the reason. The case was treated by removal of cervical screw and refixation. In the DHS group there were 2 cases of implant failure one was due to screw cut out and other was due to plate breakage with nonunion (Figure 4). In both the cases revision surgery was required. Also there were 2 cases of varus angulation in DHS group.

Table 4: Intraoperative complications in DHS group.

Complications	No of patients	Percentage
Improper insertion of compression screw	2	3.92%
varus angulation	2	3.92%

Figure 5: DHS-fracture union in varus angulation.

(Figure 5) 1 case of nonunion was seen in both the groups (Table 4). By radiological comparison of the amount of sliding seen in between the immediate postoperative X-ray & the one-year follow up X-ray in both groups. It was noted that the amount of sliding in the P.F.N group was less as compared to the dynamic hip screw.

DISCUSSION

The development of the dynamic hip screw in the 1960's witnessed a revolution in the management of unstable fractures. It allowed compression of the fracture site without complications of screw cut-out and implant breakage associated with a nail plate. However, the extensive surgical dissection, blood loss and surgical time required for this procedure often made it a contraindication in the elderly with co-morbidities. The implant also failed to give good results in extremely unstable and the reverse oblique fracture.

In the early 90s intramedullary devices were developed for fixation of Intertrochanteric fractures. These devices had numerous biomechanical and biological advantages over the conventional dynamic hip screw.[8-10] Long term studies, however, revealed that the use of these devices was associated with higher intra operative and late complication often requiring revision surgery. This has led to modifications in the device and technique of the intramedullary devices.

Kulkarni et al reviewed the current concepts of treatment of intertrochanteric fractures.[11] They concluded that unstable intertrochanteric fractures can be helped by intramedullary fixation as there is more failure of dynamic hip screw. Boldin, Seibert et al in 2000 carried a prospective study of 55 patients having proximal femoral fractures treated with the proximal femoral nail. They achieved good results in most of the patients with very less complications at 12 month follow up. They concluded that proximal femoral nail is a good minimal invasive implant for unstable proximal femoral fractures.[12]

A comparison of intra-operative findings, revealed no statistically significant differences between study groups (P =0.324 for intra-operative complications). Total duration of surgery was significantly lower in PFN group than it was in DHS ($p<0.005$). Incision size was lower in PFN group compared to DHS group ($p<0.05$).A comparison of time to union demonstrated no statistically significant differences between study groups (P= 0.542). Early and late postoperative complications were more in DHS group compared to PFN group (Table 4) (Table 5). Functional outcome of unstable intertrochanteric fractures treated with PFN has significantly better outcomes with all having good results (Figure 6).

Table 5: Intraoperative complications in PFN group.

Complications	No of patients	%
Failure to achieve closed Reduction	4	7.84%
Fracture of lateral cortex	0	0
Failure to put derotation screw	2	3.92%
Fracture displacement by nail Insertion	1	1.96%

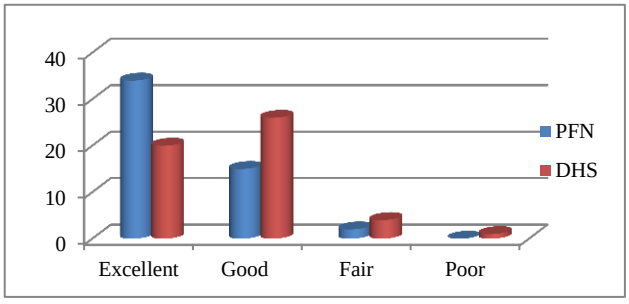

Figure 6: Functional results of the two groups.

The sliding hip screw with plate remained the gold standard for fixation of intertrochanteric fractures for years with the arrival of the intramedullary hip screw it was thought that the sliding hip screw would be replaced forever, however this is not true. The intramedullary hip screw has its own set of complications, a higher learning curve and all at a higher cost. The sliding hip screw is still the implant of choice in the stable types of intertrochanteric fractures. If the proper intra operative

guidelines are adhered to then the results in this group of patients is excellent. In the more unstable types of fracture the PFN has distinct advantages over the plate & should be the preferred implant for fixation. The need to achieve an anatomical reduction is mandatory since there is less sliding with this implant. Any gap on the post operation X-rays could always lead to a future non-union. PFN should be preferred in cases of severe osteoporosis as it has got inherent stability and being intramedullary there is no question of screw pullout which is common complication in osteoporotic fractures treated with DHS. Finally, it could be stated that the implants are here to stay; it is the fracture geometry & bone quality that will influence the choice of fixation. The quality of the reduction and proper positioning of the implant are the keys in achieving the best postoperative outcome.

CONCLUSION

We conclude that though PFN and DHS have similar outcomes in stable fractures, PFN has better functional outcome with unstable fractures. We found less operative time in PFN group, less operative blood loss in PFN group, early return to daily activities, less complication in PFN group like less infection, less sliding, less limb length discrepancy compared to DHS group. The plate and screw device will weaken the bone mechanically. The common causes of fixation failure are instability of the fractures, osteoporosis, and the lack of anatomical reduction, failure of fixation device and incorrect placement of the screw. Finally, it could be stated that the implants are here to stay; it is the fracture geometry & bone quality that will influence the choice of fixation. The quality of the reduction & proper positioning of the implant are the keys in achieving the best post-operative outcome. We found the proximal femoral nail to be more useful in unstable and reverse oblique patterns. Hence PFN is much superior to DHS in management of unstable intertrochanteric fracture femur.

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