

A Comparative Study of Intertrochanteric Fracture Femur Treated with Proximal Femoral Nailing and Dynamic Hip Screw

Sriram Sundararajan¹, Chirag V Thakkar², Subham Verma³

¹Assistant Professor, GMERS Medical College, Gotri, Vadodara.

²Associate Professor, GMERS Medical College, Gotri, Vadodara.

³Junior Resident, GMERS Medical College, Gotri, Vadodara.

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Corresponding author: Dr Subham Verma

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Abstract

Introduction: Although the effects of PFN and DHS in treatment of intertrochanteric fractures have been reported, and many studies have been done to compare both implants but the results and conclusions are not consistent and there is still ongoing controversy whether PFN is a better choice than DHS. Therefore, with the goals of better stable surgical construct of intertrochanteric fractures and early mobilization of patients, this study was planned with rationale to compare the intraoperative complications and functional and radiological outcome of intertrochanteric fractures in patients treated with dynamic hip screw and proximal femoral nail.

Materials and Methods: This study was carried out in GMERS Medical College and General Hospital Gotri Vadodara from September 2020 to December 2021, consisting of total 50 patients of intertrochanteric fractures of femur. This was a Randomized control prospective study. All the patients were operated by surgeons experienced in handling both implants. For evaluation, personal data, mode of trauma, type of fracture, type of surgery, intra operative & post operative complications, follow up examination and duration of full weight bearing were recorded.

Results: Fracture reduction in stable fractures was good and comparable in both DHS (81.25%) And PFN (80%) groups but fracture reduction in unstable fractures was better in PFN group (73%). Mean duration of hospital stay was more in DHS group(7.2 days). Union occurred in all fractures in our study but there were two cases of shortening and varus malunion in unstable type in each DHS and PFN group. Mean duration of fracture union was earlier in PFN group, [15.56 weeks] comparing to DHS group [20.64weeks]. The duration of fracture union was more in unstable type compared to stable type in DHS group but it is nearly same in both type in PFN group. Mean HARRIS hip score was more in PFN group at 6 weeks after surgery. But it became nearly equal in both groups at 20 weeks period.

Conclusion: PFN group had advantage of lesser blood loss, incision length, operative time and lesser hospital stay, Early weight bearing and early functional rehabilitation. DHS group had advantage of lesser intraoperative radiation exposure and lesser implant related intraoperative complication. Varus collapse and shortening in unstable fractures were more in DHS than PFN group but statistically insignificant. In stable fractures Both PFN and DHS are equally performing implant. But in unstable fractures PFN had edge over DHS with better functional outcome.

Keywords: Dynamic Hip Screw, Proximal Femoral Nail, Intertrochanteric Fractures.

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INTRODUCTION

Intertrochanteric fractures are common fractures encountered in orthopedic practice. It is one of the most devastating orthopedic injuries in elderly population[1]. There is an increase in the incidence of this fracture now due to increased road traffic accidents, constructions work, rise in elderly population and recent use of high dose steroid for covid19 treatment [2]. Intertrochanteric fractures exist in bimodal distribution in population. 10 percent of such fractures found in young population with history of road traffic accident, rest found in elderly population with history of minor trauma or fall at home[3-5].

Femur is the principal weight bearing bone in the lower extremity. Fracture of femur leads the patient to be bed ridden for long period leading to increased morbidity and mortality hence appropriate treatment of this fracture is must to prevent these complications[6].

Literature says that about 15 to 20% of patients with intertrochanteric fractures die within one year of injury if no appropriate treatment is given[7]. Previously these fractures were treated conservatively with traction and prolonged bed rest for 10 to 12 weeks followed by ambulation training, Such prolonged bed rest leads to increase in morbidities like bed sores, urinary tract infections, respiratory tract infections, joint stiffness etc.[8].

To avoid such complications operative treatment of intertrochanteric fractures has been tried with the aim of early bed to chair mobilization of these patient[9]. The better understanding of fracture geometry and biomechanics gradually has led to the development of a lot of implants for treating these fractures. The first one in the history was Jewett and Holt nail which was a fixed angle nail plate. This nail plate failed because of lack of controlled impaction at fracture

site.

Currently two broad categories of internal fixation devices are commonly used for intertrochanteric femoral fractures, dynamic compression hip screw with side plate assemblies and intramedullary fixation devices.

The sliding hip screw has been used traditionally for fixation of intertrochanteric fractures and became standard[10,11]. High failures were noted in those fractures with loss of posteromedial support[12]. Proximal femoral nail (PFN) and gamma nail are two commonly used devices in intramedullary fixation. Previous studies showed that gamma nail did not perform as well as DHS because it led to a relatively higher incidence of post operative femoral shaft fracture[13-14].

PFN, introduced by AO/ASIF group in 1997, has become prevalent in treatment of intertrochanteric fractures in recent years because it was improved by addition of an anti-rotation screw proximal to main lag screw. However, both benefits and technical failures of PFN have reported[15-17].

The goal of treatment in intertrochanteric fracture is early mobilization of patients to prevent morbidity and mortality.

Although the effects of PFN and DHS in treatment of intertrochanteric fractures have been reported, and many studies have been done to compare both implants but the results and conclusions are not consistent and there is still ongoing controversy whether PFN is a better choice than DHS. Therefore, with the goals of better stable surgical construct of intertrochanteric fractures and early mobilization of patients, this study was planned with rationale to compare the intraoperative complications and functional and radiological outcome of intertrochanteric fractures in patients treated with dynamic hip screw and

proximal femoral nail.

MATERIALS AND METHODS

Study Area: This study was carried out in GMERS Medical College and General Hospital Gotri Vadodara from September 2020 to December 2021, consisting of total 50 patients of intertrochanteric fractures of femur satisfying the inclusion criteria.

Sample Size: Sample Size of Total 50 patient was taken as suggested by Statistician from Department of PSM based on prevalence of these fractures.

Study Design: This was a Randomized control prospective study. All the patients satisfying inclusion criteria went through a process of Randomization by Chit System And divided into two groups (DHS and PFN group) of 25 each with the help of sealed envelopes. DHS group patients were operated with DHS implant and PFN group were operated with intramedullary nail. An informed consent was taken from each patient after admission. All the patients were operated by surgeons experienced in handling both implants. For evaluation, personal data, mode of trauma, type of fracture, type of surgery, intra operative & post operative complications, follow up examination and duration of full weight bearing were recorded.

Inclusion Criteria

1. Patient of either sex.
2. Patients with intertrochanteric fracture aged between 18-80.
3. Commitment to attend the planned follow-up and written informed consent.

Exclusion Criteria

1. Associated with any other skeletal injury.
2. Associated ipsilateral lower limb fractures.

3. Pathological fractures.
4. Severe dementia and associated psychiatric illness.
5. Medically unfit patient for surgery.
6. Patient unwilling for admission and surgery.

Data Collection: A proforma was prepared and all the details of patient were entered in that proforma after admission. Intraoperative Parameters were noted in Operation theatre.

Intraoperative blood loss was measured in terms of number of sponges used. With each sponge representing 50ml of blood loss. No suction was used to calculate blood loss. Skin incision length measured using Sterilized scale. In PFN group Length of all three incisions (entry site, proximal lag screw and distal screw) were added to get total length. Fractures were first reduced on fracture table first, after satisfactory reduction implantation was done.

Patient was made to sit in the bed after 24 hours. Quadriceps set of exercises and knee mobilization exercises were started and were asked to stand non weight bearing using walker support depending on the pain tolerability of patient. Partial weight bearing allowed from fourth week and full weight bearing after clinical and radiological signs of union were noted.

Patient was discharged after completion of treatment and was called for follow up at regular interval of 2 weeks, 1 month, 2 month and every month until fracture unites. At each visit the implant position, change in fracture alignment, fracture union, functional recovery and Harris Hip Score was noted and entered in the proforma.

RESULTS

The following observations were made from the data collected during this comparative study of proximal femoral nail and dynamic hip screw in the treatment of 50 cases of Intertrochanteric

fractures of proximal femur in the Department of Orthopaedics, GMERS Medical College Gotri, Vadodara from September 2020 to December 2021.

	Group	N	Mean	Std. Deviation	P-value
HHS (6 weeks)	PFN	9	85.89	3.621	< 0.001
	DHS	16	75.88	5.315	
HHS (20 weeks)	PFN	9	87.44	3.575	0.681
	DHS	16	86.69	5.486	

In our study majority of cases were in the age group of 61 to 70 years 18 cases [36%] Mean age of patient in DHS group was 61.76 years. Mean age of patient in PFN group was 63.84 years. Males predominated in our study [68 %]

According to Evan's Classification, 64% stable fractures and 40% unstable fracture were treated with DHS. 36% stable fracture and 60% unstable fracture were treated with PFN.

The mean duration of operation was more in DHS group (69.6 minutes) then the in PFN group (52.28 minutes) and in the DHS group its more in unstable fractures (84.44 minutes).

The mean blood loss was more in unstable fractures of DHS group (159.96 ml) as compared to PFN group (101.64 ml).

Mean length of incision was more DHS group (9 cm) comparing the PFN group (5.56 cm).

Intraoperative complications were more in PFN group [6 cases] then DHS group [3 case]

Fracture reduction in stable fractures was good and comparable in Both DHS (81.25%) And PFN (80%) group.

Fracture reduction in unstable fractures was good in PFN group (73%).

Mean duration of hospital stay was more in DHS group (7.2 days) then PFN group (3.6 days).

Time of weight bearing was late in unstable type of DHS group (11.66 weeks).

Time of weight bearing was earlier in PFN (3.96 weeks) group than DHS (7.92 weeks) and are nearly equal for both stable and unstable type.

Pain in hip occurred in 5 cases in both DHS and PFN group.

Pain in thigh occurred in 3 cases of PFN group, but there is no case of pain in thigh in DHS group.

One case of infection in DHS group & three case of infection in PFN group.

One case of lag screw cutout in DHS group and two case of 'Z' effect in PFN group.

Shortening of more than 2 cm in four case and varus displacement in four cases in DHS group, both were seen in unstable type for whom implant removal and heel raise was advised.

Post operative complications were almost equal in both groups.

Union occurred in all fractures in our study but there were two cases of shortening and varus malunion in unstable type in each DHS and PFN group.

Mean duration of fracture union was earlier in PFN group, [15.56 weeks] comparing to DHS group [20.64weeks].

The duration of fracture union was more in unstable type (23.22 weeks) compared to stable type(19.18 weeks) in DHS group but it is nearly same in both type in PFN group(15.56 weeks).

Mean HARRIS hip score was more in PFN group (81.2) at 6 weeks after surgery. But it became nearly equal in both groups at 20 weeks period.

PFN group had early rehabilitation and weight bearing.

In Stable Fractures-

In Unstable Fractures-

	Group	N	Mean	Std. Deviation	P-value
HHS (6 weeks)	PFN	16	78.56	6.164	< 0.001
	DHS	9	58	5.385	
HHS (20 weeks)	PFN	16	81.25	5.196	< 0.001
	DHS	9	68.4	5.725	

In stable fracture Harris hip score at 6 weeks was significant.

In unstable fracture Harris hip scores at 6 and 20 weeks were significant.

	Group	Mean	Std. Deviation	P-value
Duration of Surgery (min)	PFN	50.84	9.241	< 0.001
	DHS	69.6	12.978	
Blood loss (ml)	PFN	97.88	6.399	< 0.001
	DHS	159.96	16.175	
Incision length (cm)	PFN	5.48	0.918	< 0.001
	DHS	9	1.118	
Lag screw length (cm)	PFN	87	4.082	0.359
	DHS	86	3.536	
Tip apex distance (mm)	PFN	17.92	2.644	0.008
	DHS	15.88	2.603	
Total weight bearing (weeks)	PFN	4.2	1.683	< 0.001
	DHS	7.92	3.265	
Fracture union (weeks)	PFN	15.52	2.002	< 0.001
	DHS	21.28	2.441	

Except for “Lag screw length” variable, all other variables had statistically significantly different mean values when the two groups – DHS and PFN were compared as the P-value < 0.05 when tested at 5% level of significance.

DISCUSSION

Intertrochanteric fractures are a challenge to orthopedic surgeons. Besides achieving union the need here is the restoration of optimal function in shortest period with minimal complications. So the aim in treating intertrochanteric fracture has drifted to achieve stable fixation, early

mobilization and rehabilitation and making the patient functionally and psychologically independent by returning them to pre-morbid home and work environment[18].

Operative treatment of intertrochanteric fracture aid in achieving all the above aim and is the treatment of choice now.

Our study was an attempt to study, evaluate, document and quantify use of PFN and DHS in the management of Intertrochanteric fractures.

Most of our patients were in the age group of 5th to 7th decade. The mean age in

years of patients in our study was 62.80. mean age in years for group operated by PFN was 63.84. The mean age in years for group operated by DHS is 61.76. This may be because of decrease in protective reflex

in elderly patients, and so frequent fall while walking. Gallagher et al in 1980 reported that the risk of intertrochanteric fracture increases by 8 times in men over 80 years and women over 50 years[19,20].

Name of author	Age in years
Pajarinen et al 2005 ²¹	80.9
Shen et al 2007 ²²	72.1
ZHAO et al 2009 ²³	76

Age reported by another author was as follows: Increased rate of intertrochanteric fracture in elderly population are due to this region being most common site of senile osteoporosis²⁴ and is weak in elderly patients and as hip being the major weight bearing joint. the weakened part of bone in elderly patients is not able to withstand sudden abnormal stress. To prevent fractures in elderly population the risk factors such as poor lighting, slippery floor, wet slippers should be avoided.

In our study males predominated females. Majority of females who sustained fractures were between 5th to 7th decade of life. The ratio of male female was 2:1. Lovelle found trochanteric fractures more common in women than men by a margin of three to one. Melton J.L., Ilustre DM, Riggs BL et al reported a female to male ratio of 1.8. Helfenste in (1947) suggested that, by stimulation of osteoclasts due to post-menopausal deficiency of steroid hormone is responsible for greater osteoporosis. St. Urnier K.M., Dresing K (1995) suggested that intertrochanteric fractures ordinarily appear to women 10-15years later than to men. H. B. Boyd and L. L. Griffin in their study of 300 cases found a marked sex difference. 226 (75.8%) of the patients were females and 74 (24.2%) were males. Cleveland et al explained two reasons for more incidence in females. First being females have wide pelvis with tendency to have coxa vara and second less active and more prone to osteoporosis.

The reason for more incidences in males in our study is more active life style of male and more acceptance of surgery by males in our area. The reported incidence is operated incidence and not the incidence of fracture.

The mode of injury in elderly was due to domestic fall while in young was caused by to road traffic accidents. In PFN group 15 case [60 %] were due to domestic fall and 10 cases [40%] were due to road traffic accidents. In DHS group 16 cases [64%] were due to domestic fall and 9 cases were due to road traffic accident [36%]. Cummings and Nevett 1994²⁵ reported the cause for domestic fall and fracture in elderly as inadequate protective reflexes, inadequate shock absorber around thigh e.g. muscle, fat and inadequate bone strength at hip due to osteoporosis. Horn and wangs stated that it was the sudden bending and shearing stress that led to fracture than the direct injury. In case of direct injury to thigh contusion of soft tissue and comminution of lateral cortex of greater trochanter were noted.

We had 26 cases of Evans stable of which DHS was in 16 cases and PFN in 9 cases. 25 cases of Evans unstable fracture of which DHS was done in 9 cases and PFN in 16 cases.

Randomization for patient allocation was done using chit system and each patient was operated by surgeon experienced in using both implants equally. In PFN group 64% were unstable type while 36% were of stable type. In DHS group 64% were

stable type and 36% were unstable type. On statistical comparison it was found insignificant with p value more than 0.05.

In patients treated with PFN as well as DHS, two patients in each group was found to have chest infection. One other patient In DHS group was found to have urinary tract infection. The patients with chest infection were known case of COPD, as they were chronic bidi smoker. Appropriate treatment was given before surgery. Prolonged catheterization was noted as cause for urinary traction infection treated with appropriate antibiotics.

Most of cases were operated within 5 days of admission. In 6 out of 50 patients' operative procedure was delayed due to low hemoglobin. Average time lapse for surgery was 3.9 days. Evans stated that there is 30% of mortality in conservative immobilization²⁶. Active surgical approach can decrease mortality.

In our present study we have used of uniform length (220mm) long nail. As in present study we had intertrochanteric fractures of type I, II and III IV of Evans classification. So, need for using long length proximal femoral nail was eliminated. we used 135*, 4 holed barrel plate in the cases treated by DHS.

In our study Duration of surgery, Blood loss and Total incision length were measure intraoperatively. Blood loss was measured with Mop with each fully soaked mop measuring 50ml of blood loss. All three incision of PFN (entry site, proximal lag screw, distal lock) were measure and added. We found Patient treated with PFN had less operative time and blood loss compare to DHS, which was significant in case of unstable fractures. Mean length of incision in DHS was 9 cms and 5.56 in PFN group, showing more soft tissue dissection in DHS. Difference in incision length was found to be significant on analysis.

Mean duration of surgery reported by other authors-

	DHS	PFN
Kumar r singh 2012 ²⁷	87	55
Cyrill jones et al 2016 ²⁸	105	91
As Bakshi 2018 ²⁹	60	56

Mean Blood loss reported by other authors-

	DHS	PFN
Kumar r singh 2012 ²⁷	250	100
Cyrill jones et al 2016 ²⁸	159	73
As Bakshi 2018 ²⁹	292	108

In present study series nails of diameter 9mm to 12mm were used. In nine cases we used nail of diameter 9mm, In seven cases nail of 10 mm diameter, in six cases nail of 11mm diameter and in three case nail of 12mm diameter was used. In Indian population average diameter of medullary canal is found to be between 9-10 mm. Proximal femoral nail had two segments i.e., proximal and distal. Proximal segment is of 8 cm and is of uniform diameter i.e. 14mm irrespective of diameter of distal

fragment. We used screws of length 75 to 115 mm. in three cases 80 mm screw, in eleven cases 85mm screw, in nine cases 90mm, in two cases 95mm lag screw was used. Antirotation screw was used of size between 70-100mm.

All fractures were primarily reduced with controlled traction and and internal rotation. In some cases, manipulation of proximal fragment was done using Steinmann pin or blunt long artery forceps to achieve reduction. Additionally at times

3mm Steinmann pin was used for further stabilization. Implant was only applied when satisfactory and acceptable reduction was achieved. For stable fracture fracture reduction was good and comparable in both DHS and PFN, while in Unstable types PFN group had maintained better reduction. On statistical comparison this difference was found insignificant. Mean length of lag screw was comparable and insignificant between both groups. Tip apex distance of less than 25mm was achieved in all cases.

In two cases of PFN operated cases we encountered ill-fitting jig, due to this the corresponding holes in jig did not match with holes in proximal part of nail. Besides this we had one case of difficulty in fracture reduction and two case of failure in distal locking. We found difficulty in inseting two proximal screw in three cases in PFN group. One case of drill bit breakage was seen. In the DHS group we had difficulty in reduction in two cases due to comminution in fracture pattern postero-medially. Lateral cortex fracture was observed in one unstable fracture. Total 6 cases of intraoperative complications were seen in PFN group while 3 cases seen in DHS. On statistical analysis it was not found significant. PFN group had more complication attributed to relatively complex implant related instrumentation and technically difficult procedure, which is in line with the studies of Jones et al[28] and Faisal et al[30].

During follow-up in OPD, Varus deformity was noted in four cases in DHS group which was due to excessive backout, collapse and screw cutout. Shortening of 0.8 to 2cm was noted in four unstable cases in DHS group. Later heel rise was given on having complain of shortening. Varus deformity was seen in two cases in PFN group with shortening on 0.8 to 1cm. In PFN group we encountered two case of 'Z' effect and there was no case of reverse 'Z' effect. In DHS group we had one case of screw cut out. Kairuizhana, Shengzhang et

al[31] in their metanalysis on topic concluded Insignificantly higher rate of lag screw cut out and postoperative infection in DHS group. Hong xu, yang liu[32] in their metanalysis in 2022 stated postoperative complication including non-union, implant failure and revision surgery were not significantly different between PFN and DHS.

Surprisingly in our study we found Three cases of superficial wound infection in PFN group and only one case in DHS group. On further evaluation was poor personal hygiene and Poor nutritional status and low socioeconomic background were associated findings. DHS patient was diagnosed with diabetes in follow up. All infection were superficial involving dermis. Managed with debridement under local anesthesia, regular dressings and prolonged antibiotics. On statistical analysis varus malunion and shortening were found significant between stable and unstable patterns with p value less than 0.05. higher rate of infection in nailing group was found statistically insignificant.

Functional outcome of patients was measured using Modified Hip score. Hip pain was observed in 5 patients in each group. Thigh pain was seen in PFN group. Mean duration to achieve full weight bearing was 7.92 weeks in DHS while 3.96 in PFN group. Time of weight bearing was late in unstable fracture treated with DHS (11.66 weeks). In PFN group it was almost similar in both stable and unstable fractures.

In Stable fractures at 6 weeks follow up PFN group had significantly better functional outcome but it was similar at 20 weeks in both PFN and DHS. In unstable fractures PFN had significantly better functional outcome at 6 weeks and 20 weeks. Cyrill jones et²⁸ al also stated early ambulation and better functional outcome in PFN group in early postop period.

CONCLUSIONS

PFN group had advantage of lesser blood loss, incision length, operative time and lesser hospital stay, Early weight bearing and early functional rehabilitation.

DHS group had advantage of lesser intraoperative radiation exposure and lesser implant related intraoperative complication.

Varus collapse and shortening in unstable fractures were more in DHS than PFN group but statistically insignificant.

In stable fractures Both PFN and DHS are equally performing implant. But in unstable fractures had edge over DHS with better functional outcome.

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