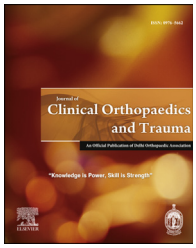
Available online at www.sciencedirect.com

SciVerse ScienceDirect

journal homepage: www.elsevier.com/locate/jcot



Original article

Comparative prospective study of proximal femoral nail and dynamic hip screw in treatment of intertrochanteric fracture femur

Ranjeetesh Kumar MBBS, R.N. Singh M.S. Ortho, FRCS, B.N. Singh M.S. Ortho, FRCS*

Anup Memorial Orthopedic Centre, 375, 77 PC Colony, Kankar Bagh, Patna 800020, India

ARTICLE INFO

Article history:
Received 9 December 2011
Accepted 26 December 2011
Available online 16 June 2012

Keywords:
Intertrochanteric fracture
Dynamic Hip Screw (DHS)
Proximal Femoral Nail (PFN)

ABSTRACT

Objectives: The aim of this study was to compare the outcome of intertrochanteric fractures treated with Dynamic Hip Screw and Proximal Femoral nail.

Methods: This study was conducted on 50 cases of Intertrochanteric fractures of femur treated by a dynamic hip screw and proximal femoral nail. Patients were operated on standard fracture table under image intensifier control.

Results: The average age of the patient was 62.3 years. Most common mechanism of fracture was domestic fall. Twenty percent four percent had stable, 58% unstable and 18% reverse oblique pattern of fracture. The unstable pattern was more common in old aged patients with higher grade of osteoporosis. The average blood loss was 100 and 250 ml in PFN and DHS group respectively. In PFN there were more no. of radiation exposure intraoperatively. The average operating time for the patients treated with PFN was 55 min as compared to 87 min in patients treated with DHS. Total complications were 15% with implant failure 6%, infection 4%, nonunion 2% and greater trochanter splintering 4%. In the PFN group the amount of sliding on X-rays was less as compared to DHS. The patients treated with PFN started early ambulation as they had better Harris Hip Score in the early period (at 1 and 3 month). In the long term both the implant had almost similar functional outcomes.

Conclusion: The DHS was tolerated better by young patients with stable fracture while PFN had a better outcome with osteoporotic patients and weak bone mass and reverse oblique fractures.

1. Introduction

Intertrochanteric fractures are defined as 'fractures involving upper end of femur through and in between both trochanters with or without extension into upper femoral shaft'. An increasing incidence of intertrochanteric fractures with advancing age is well known.

The incidence of intertrochanteric fractures varies from country to country. Gulberg et al[1] has predicted that the total no of hip fractures will reach 2.6 million by 2025 and 4.5

* *Corresponding author*. 8/A364, DDA flats, Trilok Puri, Delhi 110091, India. Tel.: +91 7654497497.
E-mail address: ranjeetesh@gmail.com (R. Kumar).

0976-5662/$ – see front matter
doi:10.1016/j.jcot.2011.12.001

million by 2050. In 1990 26% of all hip fractures occurred in Asia whereas this figure could rise to 37% in 2025 and 45% in 2050.[2]

There is hope that hip fracture risk has begun to decline in certain areas of world but reason is unknown. In Denmark the incidence of hip fractures has declined about 20% from 1997 to 2006.

Hagino et al reported a lifetime risk of hip fracture for individuals at 50 yrs of age of 5.6% for men and 20.0% for women.[3]

Any medical condition associated with bone loss, like D.M., Hyperparathyroidism, Hyperthyroidism and Cushing's syndrome is associated with a 2–7-fold rise in the risk for hip fractures.

They are the most frequently operated fracture type, have the highest postoperative fatality rate of surgically treated fractures and have become a serious health resource issue because of the high cost of care required after injury. With advancing life expectancy and geriatric care more patients who were conservatively treated in the past are now candidates for surgery, thus the need for a study to better understand the intertrochanteric fractures and the best possible means to fix them.

The various treatment options for intertrochanteric fractures are operative and nonoperative. The nonoperative method used to be treatment of choice in early 19th century when operative technique was not evolved enough to do stable fixation. Nonoperative treatment should only be considered in nonambulatory 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 diseases that itself a contraindication for insertion of a surgical implant and incomplete pertrochanteric fractures diagnosed by MRI. Nonoperative approach include reduction via traction and Early mobilization within the limits of pain tolerance.

The conservative approach has high complication rate. The common problems of prolonged immobilization, decubitus ulcers, U.T.I, joint contractures, pneumonia, and thromboembolism contribute to the high mortality rate. The increased incidence of varus deformity and shortening results in poor function.

The operative management of intertrochanteric fractures has evolved since usage of fixed nail plate, dynamic hip screws to which several modifications have been added to intramedullary devices.

The intramedullary devices offer certain distinct advantages:

1. The implant itself serves as a buttress against lateral translation of the proximal fragment
2. The intramedullary location of the junction between the nail and lag screw makes the implant stronger at resisting the binding forces
3. The intramedullary device has a reduced distance between the weight bearing axis and the implant that is a shorter lever arm.
4. 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)
5. The intramedullary hip screw is a more biological method of fixation.

For the above mentioned reasons it was believed that the intramedullary hip screw would be superior for the fixation of intertrochanteric fractures.

But there is a debate as which implant should be used in unstable fractures with special mention to osteoporotic bone and old age.

Our study was aimed at comparing the dynamic hip screw with the intramedullary hip screw device prospectively.

2. Methods

The present study was undertaken in patients more than 50 years of age with the following objectives

1. To compare the Dynamic Hip Screw and the Proximal Femoral Nail method of fixation in intertrochanteric fracture of femur in the adults with respect to intra operative parameters (total duration of surgery, intraoperative blood loss and intraoperative complication).
2. To compare the functional outcome with respect to union of the fracture, functional return, mortality and complications in the two groups.
3. To study the pattern of implant failure in the two groups and try to determine the cause and how to prevent failure.
4. To determine which implant would be ideal for which fracture type so as to provide the best results with the least complications
5. To study the long term follow up of the two groups with respect to any residual impairment of function, chronic infection and overall tolerability of implant.
6. To study in detail the types of fracture patterns seen in the intertrochanteric region with respect to mode of injury and age of the patients.

The material for the present study was obtained from the patients admitted with the diagnosis of intertrochanteric fracture femur from August 2007 to July 2010. The patients were randomly selected on first come and first inclusion basis. Fifty consecutive operated cases were selected and the patients were informed about the study in all respects and informed consent was obtained from each patient. Out of 50 patients 25 patients were treated with D.H.S and 25 with P.F.N. The inclusion criteria for the patient in this study were the surgically fit patients more than 50 years of age who has been diagnosed as having intertrochanteric fractures. The exclusion criteria were Patients unfit for the surgery, with compound or pathological fractures, admitted for re-operation and those who have not given written consent for surgery.

All the patients were carefully evaluated preoperatively which included detailed history to determine the cause of fracture and other diseases. The radiograph of pelvis with both hips and lateral view of the affected hip was taken. The fracture was classified using Orthopaedic Trauma Association (OTA) classification. Skin traction was applied to all cases.

Implant either DHS or PFN was randomly selected by operating surgeon. For DHS Length of compression screw is

measured from tip of the head to the base of greater tronchanter on AP view X-ray subtracting magnification, neck-shaft angle Neck shaft angle is determined using goniometer on X-ray AP view on unaffected side and length of side plate length of the side plate is determined to allow purchase of atleast 8 cortices to the shaft distal to the fracture.

For PFN Nail diameter was determined by measuring diameter of the femur at the level of isthmus on an AP X-ray, Neck shaft angle was measured in unaffected side in AP X-ray using goniometer and a standard length PFN (250 mm) was used in all our cases.

All cases were operated on a standard fracture table under spinal anesthesia using standard operating technique of the implant chosen. The fracture table is essential to achieve reduction and as it allows free access for the C-arm in both views.

A combination of 3rd generation Cephalosporin and Amino glycoside was administered intravenously 30 min. prior to the skin incision. The same combination was used for 48 hours postoperatively in standard doses.

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 nonweight bearing from the second postoperative 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 post operative day. Stitches were removed on the 11th 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 important parameters assessed were:

- Clinical:
  1. Wound condition
  2. Function on harris hip score
  3. Shortening
  4. Harris hip score
- Radiological:
  1. Union
  2. Amount of collapse
  3. Complication like screw cut out and z phenomena

3. Results

The study involved 50 confirmed cases of intertrochanteric femur of either sex from August 2006 to July 2010. Out of 50 cases, 25 were treated by a dynamic hip screw and 25 were treated by proximal femoral nail.

In our study maximum age was 85 years and minimum was 50 years. The average age was 69.3 years. There were 20 male and 30 female patients. The fracture due to domestic fall occurred in 31 patients (62%) while 19 patients (38%) met road traffic accident. Patients with road traffic accidents were younger while patients with domestic fall were older. The right side was involved in 21 cases while left side in 29 cases (Figs. 1–3).

The Singh's index for osteoporosis (Table 1) showed that there were 23 patients with grade 4 and above.

All the fractures were classified as per the A.O. (O.T.A.) classification. There were a total of 12 A-1 fractures, 29 A-2 fractures and 9 A-3 fractures. The various types of fractures treated with either DHS or PFN are shown in (Table 2).

3.1. *Implants used*

The dimensions of used implants in our study were:

1. D.H.S: Barrel angle (degrees)	130 – 06 patients
	135 – 16 patients
	140 – 03 patients
No. of holes	4 – 13 patients
	5 – 09 patients
	6 – 03 patients
Screw length	85 mm – 02 patients
	90 mm – 20 patients
	95 mm – 03 patients
2. P.F.N: Nail diam.	9 mm – 15 patients
	10mm – 05 patients
	12mm – 05 patients
Screw angle	130–03 patients
	135–22 patients

One patient had fracture distal third radius which was managed pop cast. Another patient who had road traffic accident had fracture of contralteral superior and inferior pubic rami which was also managed by conservative method. No other associated injury found in any other patient.

All the cases included in our study were operated as soon as possible. The delay was due to physician clearance and delay in reporting to hospital. The average delay of surgery in our study was 3 days.

3.2. *Intraoperative details*

In our study we considered various intra operative parameters like radiographic exposures, duration of surgery, amount of blood loss and other intraoperative complications.

Duration of surgery was more for DHS compared to PFN. The duration of surgery as calculated from the time of incision to skin closure was counted in each case. The average duration of surgery for the PFN (Avg. time 55 min) was significantly shorter then DHS (Avg. time 87 min).

Blood loss was measured by mop count and collection in suction drain. Blood loss was more for DHS. The average blood loss in the P.F.N group was 100 ml and in the DHS group was 250 ml. 05 out of 25 patients in DHS group required blood transfusion either intra or postoperatively.

3.2.1. *Intraoperative complications DHS*

The difficulty in reduction was encountered in cases that were delayed and in case of comminuted fractures. In 3 of 25 cases there was improper placement of Richard's screw. The screw was placed superiorly. Difficulties were encountered in reverse oblique fractures as the fracture site extended to entry point. The screw had to be inserted more proximally which resulted in varus angulation. On table surgeon had to switch to PFN in 2 cases in reverse oblique fracture. These cases were considered with PFN group (Table 3).

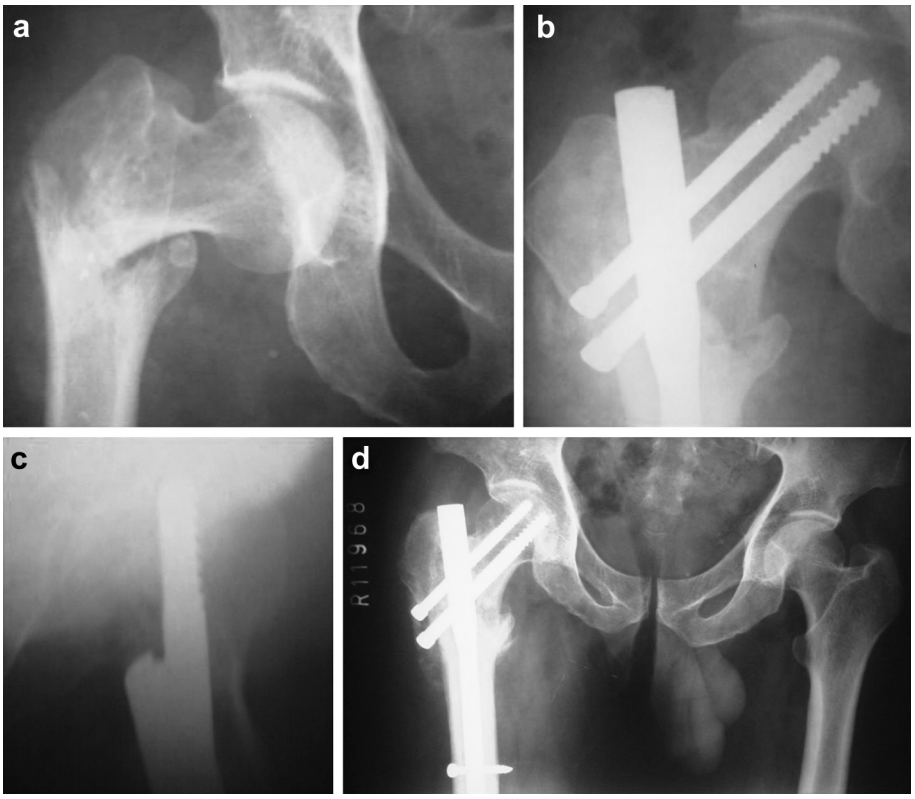


Fig. 1 – 51 Year-old male patient with intertrochanteric fracture fixed with PFN. (a) Preoperative anteroposterior view. (b and c) Immediate post operative antero posterior and lateral view. (d) Anteroposterior view at 12 week follow up.

3.2.2. *Intraoperative complications PFN*

There were iatrogenic fractures of the lateral cortex of proximal fragment in 1 of 25 of PFN. This occurred in initial cases probably due to wrong entry point and osteoporotic bone. In 3 of 25 cases, we failed to put antirotation screw, it could not be accommodated in the neck after putting neck screw. We had no difficulties in distal locking. All the cases were locked distally with atleast one locking bolt. There were no instances of drill bit breakage or jamming of nail (Table 4).

The average hospital stay was 14.24 days (12–16) days in case of DHS while 12.96 days (11–15) in case of PFN.

There were 2 cases of infection seen in the D.H.S group. They were seen within 15 days of surgery and were treated by local debridement and antibiotic and did not require implant removal.

In the PFN group one patient developed pulmonary oedema. In the D.H.S group one patient developed deep vein thrombosis. There was one death each in both groups the deaths occurred in both cases 3 months after surgery. In both cases the cause of death was not related to the surgery.

The sliding of both groups was compared at the end of 1 year on the X-rays as described by Hardy et al,[4] there was an average of 5.4 mm of sliding in the P.F.N group as compared to 7.3 mm in the D.H.S group ($p < 0.05$). The average shortening in the P.F.N group was 5.5 mm as compared to 9.9 mm in the D.H.S group. Even though there was more shortening in the D.H.S group it was not significant enough to cause any functional impairment. There was 1 (2%) case of implant failure in P.F.N group and revision surgery was required for it. The usual 'Z' pattern of implant failure was the reason.

In the D.H.S group there were 2 (4%) cases of implant failure one was due to screw cut out and other was due to plate breakage. In both the cases revision surgery was required.

In the P.F.N group there were no cases of nonunion. In the D.H.S group there was one case of nonunion which was due to jamming, this patient responded to bone grafting.

The greater trochanter splintering was seen in 2 (4%) patients but it did not cause any complication later and healed well. Greater Trochanter was either fixed with Ethibond suture or TBW.

3.3. *Functional HIP scores*

All patients were subjected to the Harris hip score[5] at the 1 month, 3 months, 6 months and one yearly two yearly follow ups.

In the D.H.S group the 1 month hip score (Avg. 24.4) was less than that of the P.F.N group (Avg. 33), $p < 0.05$ however this difference disappeared with the two group on the sixth monthly and yearly follow up with both scores being same (D.H.S-93 and P.F.N-93). At 2 years the score was similar for both implants i.e. 97 (Table 5).

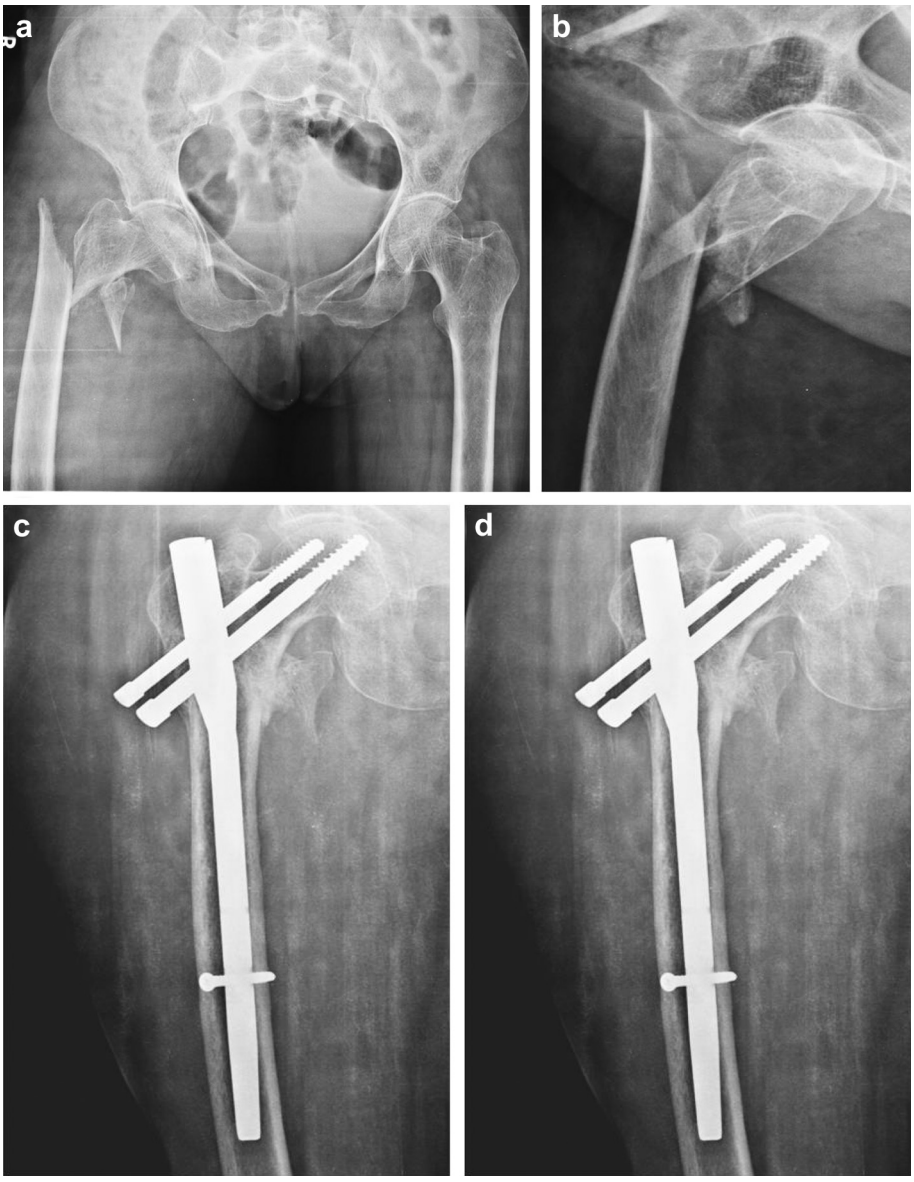


Fig. 2 – 76 Year-old female patient with fracture fixed with PFN. (a and b) Preoperative anteroposterior and lateral view. (c and d) Anteroposterior and lateral radiograph at 12 week follow up.

4. Discussion

In the last 3–4 decades treatment of intertrochanteric fractures has changed significantly. A large number of fixation implants has been devised and discarded. The treatment still merits the type of fracture and condition of patient.

The development of the dynamic hip screw in the 1960's saw a revolution in the management of unstable fractures. The device 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 comorbidities. 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.[4,6,7] 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 lead to modifications in the device and technique of the intramedullary devices.

A review of literature will reveal several studies[8–13] on the comparison of the dynamic hip screw to intramedullary nail. All of them aimed to compare intra and postoperative complications, postoperative function, union rates and implant failure rate between the two.

4.1. *Sliding properties*

The sliding properties of both implants vary considerably. Siding is an essential principle in the management of

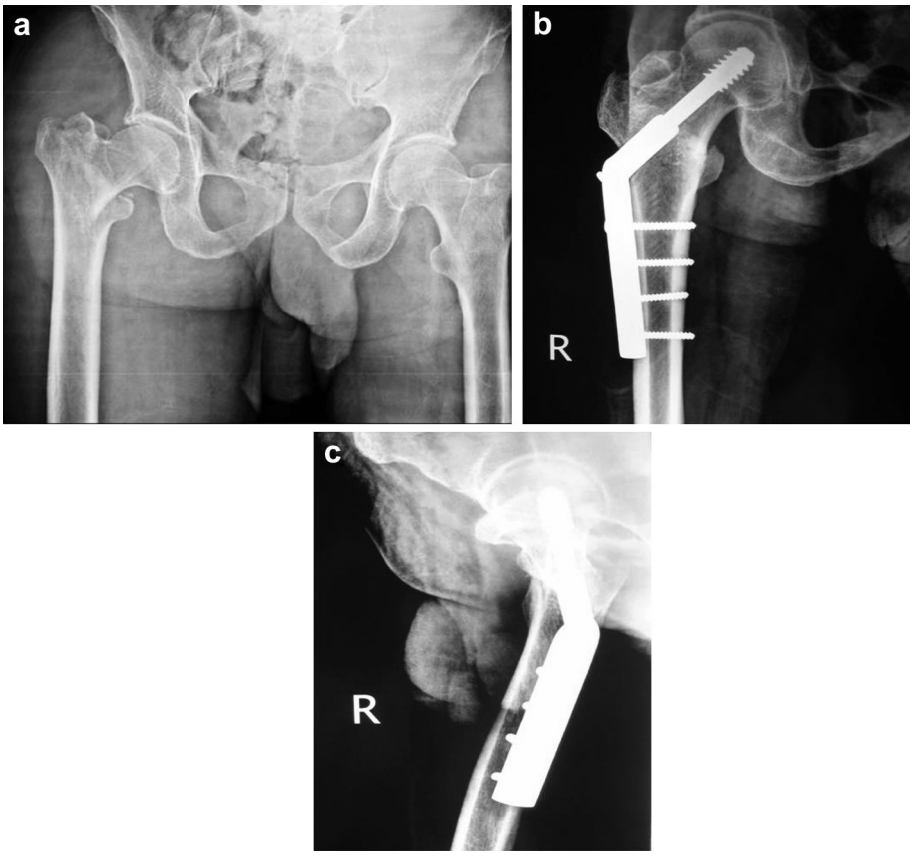


Fig. 3 – 63 Year-old male with fracture fixed with DHS. (a) Preoperative anteroposterior view. (b and c) Anteroposterior and lateral radiograph at 12 weeks follow up.

intertrochanteric fractures. Sliding permits impaction of the fracture fragments thus promoting healing.

Kyle et al[14] in his extensive study of the biomechanical principles of the sliding hip screw has identified key factors that promote sliding, A reduction in the bending forces is vital since bending forces reduce slide and cause jamming of the implant. The bending forces are increased by:

1. Longer extension of the screw.
2. Smaller screw angle.
3. Heavier patients.

Table 1 – Fracture type, sex distribution and type of implant used.

Fracture type	Male	Female	P.F.N	D.H.S
A1-1	1	3	–	4
A1-2	3	2	–	5
A1-3	3	-	1	2
A2-1	4	6	5	5
A2-2	6	8	7	7
A2-3	1	4	3	2
A3-1	2	1	3	–
A3-2	–	2	2	–
A3-3	–	4	4	–

In his subsequent studies on the sliding in second generation locked nails, Kyle et al[14] has noted that increased forces are required to initiate sliding in intra medullary devices as compared to sliding hip screw with plate. Amongst all intra medullary devices the Gamma nail requires the largest force. The explanation lies in the barrel of the side plate, the barrel provides a free passage for the screw to slide, thus the longer the barrel length the less the forces required to initiate sliding (Table 6).

4.2. *Barrel plate angle*

The most routinely used barrel plate angle in most studies is 135°; this is because of the ease of insertion and the more anatomical restoration of femoral neck angle. However the

Table 2 – Singh's index.

Grade	No. of PTS (%)
I	03 (06%)
II	08 (16%)
III	16 (32%)
IV	8 (16%)
V	5 (10%)
VI	10 (20%)

Table 3 – Intraoperative complications DHS.

Intraoperative complication	No of cases	Percentage
Improper insertion of compression screw	3	12%
Varus angulation	2	8%

150 degree side plate has several advantages, since the forces are acting more in line with the screw less bending forces act across the screw so relatively less force is required to initiate sliding resulting in more impaction.[15,16] Valgus hips are however more prone to develop early O.A.

4.3. *Sliding length*

Gundle et al[17] has noted a positive correlation between sliding length and union. In his study he found that fractures fixed with a sliding length (i.e. the distance from proximal tip of the barrel to the distal thread of the screw) of less than 10 mm had 3 times higher rate of failure than those with sliding length more than 10 mm. This is particularly true in devices that have a 32 mm threaded screw length with a 32 mm barrel. He thus recommends a short barrel for screws with less than 85 mm screw length.

In the present study 50 patients of either sex with Inter-trochanteric fractures were studied.

In our study the average age was 69.3 years which was comparable to Indian as well as western authors with similar study. We had an 1:1.5 male: female ratio unlike male predominance in the Indian authors.

The most common mode of injury in our study was domestic fall 62%, which is comparable to most of the Indian studies. This was also affected by the age as the older the patient more likely he/she getting the fracture by domestic falls. In our study 24% were stable fracture pattern and 76% were unstable. In 58% of cases left limb was involved. Osteoporosis was measured by the Singh's index. More osteoporosis was present in the older patient and post-menopausal females. In our study 32% had a grade – III osteoporosis.

The average intra operative blood loss was very minimal in the P.F.N. The average blood loss in the P.F.N group was 100 ml and in the D.H.S group was 250 ml. The radiation exposure was more in case of P.F.N (Avg. no. of exposure 70) while in DHS it was 40.

The average operating time for the patients treated with P.F.N was 55 min as compared to 87 min in patients treated with D.H.S. We had a greater operating time in the beginning which reduced greatly in the later part of the study. This signifies the learning curve of the proximal femoral nailing.

Table 4 – Intraoperative complications PFN.

Complication	Number of cases	Percentage
Failure to achieve closed reduction	0	0
Fracture of lateral cortex	1	4%
Failure to put derotation screw	3	12%
Fracture displacement by nail insertion	1	4%

The average hospital stay was higher in DHS (14.24 days) because in cases of PFN All the stitches were removed on 10th day in most of the cases.

Total complications in our study were 15%. 3 of our patient had implant failure. There was one case of non-union which responded to bone grafting. 4% of our patients had greater trochanter splintering while inserting the nail. Infection was present in 4% of the patient. They were seen within 20 days of surgery and were treated and did not require implant removal.

By radiological comparison the amount of sliding seen between the immediate postoperative X-ray the one year follow up X-ray in both the groups, it was noted that the amount of sliding in the P.F.N group was less as compared to the dynamic hip screw. This was a result of the proximal part of the nail blocking the head and neck fragment, this finding is in accordance with the studies of Kyle et al[14] and Hardy et al.[4]

The success of proximal femoral nail depended on good surgical technique, proper instrumentation and good C-arm visualization. All the patients were operated on fracture table.

Placement of the patient on the fracture table is important, for better access to the greater trochanter the upper body is abducted away 10–15°. Position of the C-arm should be such that proximal femur is seen properly in AP and lateral view. The anatomical reduction and secure fixation of the patient on the operating table are absolutely vital for easy handling and good surgical result.

The entry point of the nail was taken on the tip or the lateral part of the greater trochanter.

As the nail has 6° of valgus angle medial entry point causes more distraction of the fracture. The hip pin is inserted 5 mm away from the subchondral bone in the lower half in the AP view and center on the neck in the lateral view. The cervical pin is placed parallel to the hip pin in AP view and overlapping it in the lateral view. It should be 10 mm shorter than the hip pin from the subchondral bone. This ensures that the cervical screw will not take the weight load but only fulfill the anti-rotational function. Failure to do this leads to the "Z effect". In which the cervical pin backs out and the hip pin pierces the joint or the vice-versa.

Distal locking was done with the interlocking bolts. In most of the cases only dynamic hole was locked. In our study one of the important factor was the cost of the implant as proximal femoral nail is costly than the dynamic hip screw, but at the end it didn't cause much of the difference as:

- Less operative time thus reducing the cost
- No or less need of transfusion of blood
- Postoperative antibiotics were used less reducing the cost of the drugs
- Less hospital stay
- Early return to daily activities.

Dynamic hip screw introduced by Clawson in 1964 remains the implant of choice due to its favorable results and low rate of complications. It provides control compression at the fracture site. Its use has been supported by its biomechanical properties which have been assumed to improve the healing of the fracture.

But Dynamic hip screw requires a relatively larger exposure, more tissue trauma and anatomical reduction. All these

Table 5 – Comparison between the PFN and DHS.

	P.F.N ($n = 25$)	D.H.S ($n = 25$)	p-Value
Blood loss	100[a] ml ± 16.40[b] ml	250[a]ml ± 44.98[b] ml	<0.05
Radiation exposure	70[a]+1.6(in no.)	40[a]+4 (in no.)	
Duration of surgery	55[a] min ± 18[b] min	87[a] min ± 3.2[b] min	<0.05
Hospital stay	13.96[a] days	14.24[a] days	
Harris hip score at 1 month	33[a] ± 0.4[b]	24.4[a] ± 3.3[b]	<0.05
Harris hip score at 3 months	58[a] ± 5.6[b]	53[a] ± 3.0[b]	<0.05
Harris hip score at 6 months	88[a] ± 2.5[b]	85[a]±1.6[b]	>0.05
Harris hip score at 1 Year	93[a] ± 2.7[b]	93[a] ± 2.1[b]	>0.05
Harris hip score at 2 Year	97[a] + 2	97[a] + 2	>0.05
Sliding	5.5[a] mm	7.3[a] mm	<0.05
Shortening	5.4[a] mm	9.9[a] mm	<0.05
Implant failure	1 (2%)	2 (4%)	<0.05
Non-union	0	1 (2%)	<0.05
Deaths	1 (2%)	1 (2%)	>0.05
Infection	0	2 (4%)	<0.05
Med. com.	1 (2%)	1 (2%)	>0.05
GT splintering	2 (4%)	0	>0.05

a Indicates a mean of all observed data.
b Indicates one standard deviation (S.D).

increase the morbidity, probability of infection and significant blood loss. It also causes varus collapse leading to shortening and inability of the implant to survive until the fracture union.

The plate and screw device will weaken the bone mechanically. The common causes of fixation failure are instability of the fractures, osteoporosis, lack of anatomical reduction, failure of fixation device and incorrect placement of the screw.

We found proximal femoral nail to be more useful in unstable and reverse oblique patterns due to the fact that it has better axial telescoping and rotational stability as it is a load shearing device.[14,18,19] It has shown to be more biomechanically stronger because they can withstand higher static and several fold higher cyclical loading than dynamic hip screw. So the fracture heals without the primary restoration of the medial support. The implant compensates for the function of the medial column.

Proximal femoral nail also acts as a buttress in preventing the medialization of the shaft. The entry point of the proximal femoral nail is at the tip of the greater trochanter so it reduces the damage to the hip abductors unlike the nails which has entry through pyriformis fossa. The hip screw and the anti rotation cervical screw of the Proximal femoral nail adequately compress the fracture, leaving between them adequate bone block for further revision should the need arise.

4.4. *Nail or plate*

The sliding hip screw with plate remained the gold standard for fixation of intertrochanteric fractures for years. With the arrival of the intra medullary hip screw it was thought that the sliding hip screw would be replaced forever, however this is not true the intra medullary hip screw has its own set of complications, more exposure to radiation, a higher learning curve and all at a higher cost.

The dynamic hip screw is still the implant of choice in the stable types of intertrochanteric fractures. If the proper intra operative guide lines are adhered to then the results in this group of patients is excellent. In our study we had to change the plan from DHS to PFN in two cases intraoperatively.

In the more unstable types of fracture the intra medullary hip screw has distinct advantages over the plate and 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 postoperative X-rays could always lead to a future non-union.

Table 6 – Comparison of few published studies using nail for trochantric fracture with current study.

Name of study	Number of cases		Age	Blood loss		Time		Nonunion		Shaft	Infection	
	IMN	DHS		IMN	DHS	IMN	DHS	IMN	DHS	#'s	IMN	DHS
Hardy[50]	50 (Gamma nail)	50	79	144	198	71	57	0	1	2	0	0
Leung[48]	113 (Gamma nail)	113	78	765	1157	53	42	1	0	2	1	3
Bridle[47]	49 (Gamma nail)	51	81.5	116	133	36	33	–	–	4	1	2
Pajarinen[53]	54 (P.F.N)	54	79	320	357	55	45	–	–	–	–	–
Little[54]	92 (Holland nail)	98	83.4	78	160	54	40.3	–	–	–	5	10
Current series	25 (P.F.N)	25	62.3	100	250	55	87	0	1	0	0	2

In conclusion both the implants are here to stay, it is the fracture geometry and bone quality which will influence the choice of fixation .The quality of the reduction and proper positioning of the implant are the keys to achieving the best postoperative outcome.

Conflicts of interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES

1. Gulberg B, Jhonell O, Kanis J. Worldwide projection for hip fractures. *Osteoporos Int*. 1997;7:407–413.
2. Melton LJ 3rd, Kearns AE, Atkinson EJ, et al. Secular trends in hip fracture incidence and recurrence. *Osteoporos Int*. 2009;20(5):687–694.
3. Hagino H, Furukawa K, Fujiwara S, et al. Recent trends in incidence and lifetime risk of hip fracture in Tottori. *Japan Osteoporos Int*. 2009;20(4):543–548.
4. Hardy D, Descamps P, Krallis P, et al. Use of an intramedullary hip screw compared with a compression hip screw with a plate for intertrochanteric femoral fractures. A prospective randomized study of one hundred patients. *J Bone Joint Surg Am*. 1998;80:618–630.
5. Harris WH. Traumatic arthritis of the hip after dislocation & ace tabular fractures: Treated by mould arthroplasty. An end result study using a new method of result evaluation. *J Bone Joint Surg Am*. 1969;51:737–755.
6. Spivak JM, Zuckerman JD, Kumme FJ. Fatigue failure of sliding hip screw in hip fractures a report of three cases. *J Orthop Trauma*. 1991;3:325–331.
7. Leung KS, So WS, Shen WY, Hui PW. Gamma nails and dynamic hip screws for pertrochanteric fractures. A randomized prospective study in elderly patients. *J Bone Joint Surg Br*. 1992;74:345–351.
8. Adams CI, Robinson CM, Court-brown CM, Mc-Queen MM. Prospective randomized controlled trial of an intra medullary nail vs. dynamic hip screw with plate for the intertrochanteric fractures of the femur. *J Orthop Trauma*. 2001;15:394–400.
9. Ahrengart L, Tornkvist H, Fornander P, et al. A randomized study of the compression hip screw & the Gamma nail in 426 fractures. *Clin Orthop*. 2002;401:209–222.
10. Pajarinen J, Lindahl J, Michelsson O, Savolainen V, HirvensaloE. Pertrochanteric femoral fractures treated with a dynamic hip screw or a proximal femoral nail: a randomized study comparing post-operative rehabilitation.
11. Little NJ, Verma V, Fernando C, Elliott DS, Khaleel A. A prospective trial comparing the Holland nail with the dynamic hip screw in the treatment of intertrochanteric fractures of the hip. *J Bone Joint Surg Br*. Aug 2008;90-B:1073–1078.
12. Baumgaertner MR, Chrostowski JH, Levy RN. In: Browner BD, Levine Am, Jupiter JB, eds. *Skeletal Trauma*, Vol. 2. Philadelphia: WB Saunders; 1992:1833–1881.
13. Wiss DA, Morrey BF, Baumgaertner MR, Koval KJ. *Master Techniques in Orthopaedics: Fracture*. 2nd ed. Philadelphia: Lippincot Williams & Wilkins; 2006:233–264.
14. Kyle RF, Wright TM, Burstein AH. Biomechanical analysis of the sliding characteristics of compression hip screws. *J Bone Joint Surg Am*. 1980;62:1308–1314.
15. Baumgaertner MR, Curtin SL, Lindskog DM, Keggi J. The value of the tip-apex distance in predicting failure of fixation of peritrochanteric fractures of the hip. *J Bone Joint Surg Am*. 1995;77:1058–1064.
16. Gl Wolfgang, Bryant MH, O'Neil JP. The treatment of intertrochanteric fractures of the proximal femur using sliding screw plate fixation. *Clin Orthop*. 1982;163:148–158.
17. Gundle R, Gargan MF, Simpson AHRW. How to minimize failure of fixation of unstable intertrochanteric fractures. *Injury*. 1995;26:611–614.
18. Boyd HB, Griffin LL. Classification & treatment of intertrochanteric fractures. *Arch Surg*. 1949;58:853–866.
19. Jensen JS, Michaelsen M. Trochanteric fractures treated with McLaughlin plate. *Acta Ortho Scand*. 1975;46:795–803.