Section: Orthopaedics

Original Research Article

TREATMENT OF REVERSE TROCHANTERIC AND FRACTURES WITH LATERAL WALL COMMINUTION WITH FAILED DYNAMIC HIP SCREW, USING PROXIMAL FEMORAL /RECONSTRUCTION NAIL (INTRAMEDULLARY NAIL) AND BONE GRAFT

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ABSTRACT

Background: Hip fractures are a leading source of illness and mortality in the elderly population, with a one-year mortality rate of up to 30%. The global yearly incidence of hip fractures is anticipated to be around 1.6 million, rising to 2.6 million by 2025 and 4.5 million by 2050 as the world's population ages. The objective is to compare the radiological and functional outcomes of Proximal femoral nail/ reconstruction nail and Dynamic hip screw (DHS) in the management of intertrochanteric fractures.

Materials and Methods: This Prospective Observational Study was conducted Department of Orthopaedics, FH Medical College & Hospital, Agra, UP India. All the patients attending Orthopaedics Emergency and OPD of FH Hospital during the period of study with trochanteric fractures above 18 years of age of both sexes were included in the study. Duration of study was December 2020 to November 2022.

Results: Forty patients treated with Proximal femoral nail/ reconstruction nail and forty with DHS were included in the study. The PFN/Reconstruction Nail required shorter incision, less blood loss and operative time. The DHS required 16.25 seconds less fluoroscopy time. Patients treated with Proximal femoral nail/ reconstruction nail had significantly better pain score at the 3 months and 6 months of follow up. Patients treated with DHS had more limb length shortening as compared to those treated with Proximal femoral nail/ reconstruction nail. All the patients treated with Proximal femoral nail/ reconstruction nail had comparatively better Harris hip score at subsequent follow ups.

Conclusion: The proximal femur nail/Reconstruction Nail offers a stable fixation, minimizes the stress and allows early mobilization. It offers a superior stabilization than other currently used implants for such fracture.

Keywords: Functional, Clinical and Radiological outcome, Intertrochanteric fractures, femur, Proximal Femoral Nail PFN/Reconstruction Nail, Dynamic Hip Screw.

INTRODUCTION

Intertrochanteric fracture is one of the most common hip fractures, particularly in elderly patients with osteoporotic bones, and is typically caused by low-energy trauma such as simple falls.[1] The incidence of intertrochanteric femoral fractures has increased dramatically over the past few decades, and this trend is likely to continue in the near future due to the ageing population and the prevalence of osteoporosis.

Extramedullary implants and intramedullary nails are the most common implant types utilized for treating these fractures. The fracture pattern, which

may be stable or unstable, largely determines the implant selection. Stable intertrochanteric fractures are often uncomplicated fractures that are less susceptible to vertical stress when standing on one leg. Nonetheless, an unstable intertrochanteric fracture typically affects both the medial and lateral femoral cortex, making it more stress vulnerable. Unstable intertrochanteric fractures are characterized by significant disruption of the posteromedial cortex due to comminution, reverse oblique patterns, or subtrochanteric extension. Fractures without subtrochanteric extension or rupture of the posteromedial cortex are considered stable. Several clinical and biomechanical research,[2] have investigated the outcomes of various implants, including the dynamic hip screw (DHS), the Gamma nail (GN), and the proximal femoral nail (PFN)/ reconstruction nail.

The type of implant utilized will eventually influence the result and any complications that may accompany the fracture and its fixation. For fixation, the dynamic hip screw (DHS) and sliding plate device are already widely utilized. However, if early weight bearing is initiated, especially in the case of complex and comminuted fractures, the device may pierce or retract through the head. The proximal femoral nailing (PFN) is the intramedullary device that has been generally reported to have been beneficial in such fractures due to its location near to the mechanical-axis of the body, hence reducing the lever arm aspect of the implant.

From country to country, the incidence of intertrochanteric fractures varies. Gulberg et al. have anticipated that the number of hip fractures will reach 2.6 million by 2025 and 4.5 million by 2050.[3] In Asia, intertrochanteric fractures accounted for 26% of all hip fractures in 1990; by 2025 and 2050, this percentage is projected to climb to 37% and 45%, respectively.[4] The objective of treatment for these fractures is to achieve stable fixation, allowing for rapid patient movement. Significant morbidity and mortality are associated with these fractures. Associated co-morbid medical conditions, such as diabetes, hypertension, pulmonary, renal, and cardiac disorders, exacerbate the damage caused by the fracture. Complications such as hypostatic pneumonia, catheter sepsis, cardiopulmonary failure, and decubitus ulcer pose a threat to the lives of elderly individuals. All the aforementioned situations need the utilisation of an emergency surgical procedure to expedite the patient's recovery and movement.[5]

This study was aimed to compare the radiological and functional outcomes of Proximal femoral nail/ reconstruction nail and Dynamic hip screw (DHS) in the management of intertrochanteric fractures.

MATERIALS AND METHODS

This Prospective Observational Study was conducted Department of Orthopaedics, FH Medical College & Hospital, Agra, UP India. All the patients attending Orthopaedics Emergency and OPD of FH Hospital during the period of study with trochanteric fractures above 18 years of age of both sexes were included in the study. Duration of study was December 2020 to November 2022.

Inclusion Criteria

Patient with trochanteric fractures of both sexes above 18 years of age.

Exclusion Criteria

1. Pathological Trochanteric fractures.
2. Patients not fit for Anaesthesia or surgery due to life threatening diseases.

Preoperative evaluation: In all patients, history of mode of injury, associated co-morbid condition were taken followed by Clinical assessment of the patients for Head, Abdomen, Chest injuries or any other injuries in detail. Patient was treated initially by Skin traction / Skeletal traction as per his/her requirement to immobilize the limb, to check the development of deformity, to relieve from pain and to reduce the swelling at local site. Oral or parenteral Analgesics and Anti-inflammatory were administered.

After clinical examination and pathological investigations, patient's fitness for anaesthesia was assessed. Patient having any respiratory or cardiac problem was referred to Medicine department for better assessment.

Proximal Femoral Nail

Pre-op planning

- Templating of nail diameter: Nail diameter templating of the femur was done at the level of isthmus on an AP X ray.
- Determination of neck shaft angle: Neck shaft angle was measured in unaffected normal side on an AP x-ray using goniometer.

RANGE: 123 degrees – 137 degrees

AVERAGE: 130 degrees

- Length of the Neck: It was measured in 15 degrees internal rotation X- ray of normal unaffected hip i.e., after correction of the Anteversion of the neck.

Post op protocol for proximal femoral nail / reconstruction nail:

- Post-operative vitals monitoring of patients was done.
- Post-operative intravenous antibiotics were given for 3-5 days and then oral antibiotics and analgesics were continued for another one week.
- On 1st post-operative day Hip and knee range of motion exercises were taught and the patient was encouraged to do so under supervision.
- DVT prophylaxis was given to obese patients.
- Dressing was changed on the day of discharge.
- Sutures were removed on 12th-15th post-operative day.

Dynamic Hip Screw

Pre-op planning

- Determination of neck shaft angle: Neck shaft angle was measured in unaffected normal side on an AP x-ray using goniometer.

RANGE: 123 degrees – 137 degrees
AVERAGE: 130 degrees

- Length of the Neck: It was measured in 15 degrees internal rotation X- ray of normal unaffected hip i.e., after correction of the Anteversion of the neck.
- Size of the Richard Screw and Barrel plate: Size of the screw was determined by the length of the neck measured

Follow up for proximal femoral nail/ reconstruction nail & dynamic hip screw:

- Follow up of the patient was done at 2 weeks, 6 weeks, 3 months, 6 months, 9 months and 12 months post operatively.
- Patients were examined as per Harris Hip score on the following parameters.
- Pain, Walking, Sitting, Turning, Knee Flexion-Extension Exercises
- Hip Movement
- Passive
- Active
- Length of the Limb
- Gait

Functional outcome was assessed based on Harris hip Score.

Statistical Analysis: The collective data analysed by the Z-test, Student t-test, Chi-Square test ($x2$), Wilcoxon signed rank sum test and the Mann Whitney U test using SPSS software to evaluate the results.

RESULTS

The most common age group was in the range of 51 – 75 with a mean of 60.25 yrs. 60 percent of the total patients were female in this study. The most common mode of injury was trivial fall. Left side is involved in 52% of the patients.

Table 1: Preinjury walking ability

	Method of fixation		Total
	DHS	PFN	
Grade 1	32 (80.0%)	30 (75.0%)	62 (77.5%)
Grade 2	8 (20.0%)	10 (25.0%)	18 (22.5%)
Total	40 (100.0%)	40 (100.0%)	80 (100.0%)

The pre-injury walking ability of the patients was classified as per grades described by Sahlstrand74: Pre-injury walking ability was similar in both the groups.

Table 2: Length of Incision

Method	N	Mean (cm)	Std. Deviation	(t)
DHS	40	16.5	16.5 ± 1.34	22.569
PFN	40	8.1	8.10 ± 0.85	P = 0.0001 HS

Patient treated with proximal femoral nailing required a significantly smaller skin incision.

Table 3: Duration of Surgery

Method	N	Mean (min.)	Std. Deviation	T-Test	P Value
DHS	40	87.10	5.44618	20.83	<0.001
PFN	40	59.075	6.53511		

Proximal femoral nailing/reconstruction nailing required mean 28 minutes less operative time as compared to Dynamic Hip Screw fixation.

Table 4: Fluoroscopy Time

Method	N	Mean (sec.)	Std. Deviation	Z
DHS	40	57.5	57.50 ± 3.80	24.59
PFN	40	73.75	73.75 ± 9.98	P = 0.0001 HS

Dynamic hip screw required significantly less fluoroscopic time as compared to proximal femoral nailing.

Table 5: Intraoperative Blood loss

Method	N	Mean (ml)	T-Test	P Value
DHS	40	171.75	32.5	<0.001
PFN	40	74.50		

Dynamic hip screw fixation has significantly less intra operative blood loss as compared to proximal femoral nailing.

Table 6: Post operative Pain

Duration	Method of Fixation	
	DHS	PFN
6 Weeks	30	40
3 Months	30	40
6 Months	40	44
9 Months	44	44

Table 7: Post operative Mobility Score

Method		N	Mean	Std. Deviation	Z	P
DHS	Preoperative mobility score	40	1.20	0.4577	2.879	0.004 S
	Preoperative mobility score	40	2.25	0.5936		
PFN	Preoperative mobility score	40	1.15	0.4140	2.530	0.011 S
	Preoperative mobility score	40	1.45	0.5936		

Twenty patients in the Proximal femoral nail/ reconstruction nail group regained their pre-injury walking ability at third month follow up as compared to ten in the DHS group

Table 8: Post operative Walking (Harris hip score)

Duration	Method of Fixation	
	DHS	PFN
6 Weeks	18	30
3 Months	30	33
6 Months	33	33
9 Months	33	33

Significantly less limb length shortening was seen in the Proximal femoral nail/ reconstruction nail group as compared to the DHS group with a mean of 1.25cms in the DHS group and 0.575cms in the PFN/ reconstruction nail group.

There were significantly better mean post operative range of movement in PFN and DHS with 84.25 degree mean in DHS group and 98.75 degree mean in PFN/ reconstruction nail group. All the fracture united at a mean of 12.075 weeks.

Table 9: Post operative Functional outcome

	Method of Fixation		
	DHS	PFN	
6 Weeks	65	80	Chi square – 0.84
3 Months	77	90	P-value – 0.83

6 Months	90	94	
9 Months	92	96	

Table 10: Functional Outcome versus Method of fixation

	Method of Fixation		Total	Chi - square test	P Value
	DHS	PFN			
Excellent	6 (15.0%)	8 (20.0%)	14 (17.5%)	17.09	0.0006
Good	14 (35.0%)	30 (75.0%)	44 (55.0%)		
Fair	12 (30.0%)	2 (5.0%)	14 (17.5%)		
Poor	8 (20.0%)	0 (0.0%)	8 (10.0%)		
Total	40 (100.0%)	40 (100.0%)	80 (100.0%)		

DISCUSSION

All the fractures that occurred in patients younger than 58 years were either due to fall from height or a road traffic accident. This supports the view that bone stock plays an important role in the causation of fracture in the elderly, which occur after trivial fall. No attempt was made to measure the degree of osteoporosis by the Singh's index as it involves a great inter-observer variability and depends on good quality x- rays. In addition, the accuracy of the Singh index has been questioned by authors such as Koot et al.[6]

White and colleagues did a study of rate of mortality for elderly patients after fracture of the hip in the 1980's and they concluded that the average age of trochanteric fractures is 75.4 years. The average age in our study nearly correlates to that of White and his colleagues.[7]

In our study there were 32 males and 48 females showing female preponderance. Dahl and colleagues8, in their study 65% of the patients were females, explained by the fact that females are more prone to osteoporosis after menopause. Sex distribution in our study also correlates with that of other studies.

Commonest mode of injury is trivial fall which was noted in 60 patients (75%). History of fall from height was in 8 patients (10%).[8]

All the fractures that occurred in patients younger than 58 years were either due to a fall from height or a road traffic accident. This supports the view that bone stock plays an important role in the causation of fractures in the elderly, which occurs after a trivial fall. The length of the incision in the DHS group ranged from 14 cm to 18 cm with a mean of 16.15 cm as compared to only mean of 8.1 cm in the Proximal femoral nail/ reconstruction nail group. The smaller incision in the PFN group meant that there was less intra operative blood loss. This was comparable to the study conducted by Baumgaertner et al.[9]

The duration of surgery in the DHS group ranged from 75 minutes to 98 minutes with a mean of 87.10 minutes. The duration of surgery in the Proximal femoral nail/ reconstruction nail group ranged from 50 minutes to 70 minutes with a mean of 59.075 minutes. The difference in the operative times in both groups was found to be highly significant and we attributed this difference to the smaller incisions in the PFN group. Baumgaertner et al,[9] also found that the surgical time were 10 percent higher in the DHS group in their series.

The fluoroscopy time in the PFN/reconstruction nail group (average 73.75 sec) was significantly higher as compared as compared to that of the DHS group (average 57.5 sec). This was similar to the series by Baumgaertner and associates,[9] who also found a significant difference in the fluoroscopic times in their series, with 10 percent higher times for the Proximal femoral nail/ reconstruction nail group. However, in their study Saudan et al,[10] found no difference between the fluoroscopy time in both the groups.

The DHS patients had significantly more blood loss (average 150 ml) intra- operative compared to PFN group (average 80 ml). This is similar to the series by Baumgaertner and associates,[9] who also found a significant difference in the intra operative blood loss in their series, with 150 ml higher for the DHS group.

Post operative Pain: In our study we found significant difference in post operative pain in the two groups at 6 weeks and 3 months (better score in Proximal femoral nail/ reconstruction nail group as compared to DHS group) which was significantly reduced in DHS group at post operative 6-month interval and similar to that of Proximal femoral nail/ reconstruction nail group at 9 months and 1 year post operatively. Saudan and colleagues,[10] found that the amount of persistent pain was similar in both group in their series.

Post operative range of hip movement: The average range of motion of the hip joint was 84.25 degree in the DHS group and 98.75 degree in the Proximal femoral nail/ reconstruction nail group at 6 months of follow up. Hence, in our study the patient in the Proximal femoral nail/ reconstruction nail group regained a significantly better range of motion as compared to those in the DHS group (p=0.002). This is comparable to the results put forth by Saudan and colleagues.[10]

Functional Outcome: The overall functional outcome of patient treated with Proximal femoral nail/ reconstruction nail was significantly better compared to DHS. In our series, only 10 of the 40 patients (25 percent) in the DHS group regained their pre-injury mobility level as compared to 28 of the 40 patients (70 percent) in the Proximal femoral nail/ reconstruction nail group at 4 months of follow up. Similar finding was seen in the series by Pajarinen and group.[11] This suggests that the use of

Proximal femoral nail/ reconstruction nail may be favoured when compared to DHS. There is some amount of shortening in the DHS group which can be explained as due to significantly greater impaction of the fracture in the DHS group.

The smaller incision, shorter operative time, relatively less blood loss, less post operative pain (with Proximal femoral nail/ reconstruction nail) and a better functional outcome indicates that the Proximal femoral nail/ reconstruction nail has an advantage over the DHS in managing Intertrochanteric fractures.

CONCLUSION

Proximal femur nail/Reconstruction Nail has widened the indication of intra medullary nailing for more complex fractures of the proximal femur i.e., Intertrochanteric fractures. By doing closed reduction, it offers a minimal soft tissue damage, preserves the fracture hematoma, decreased blood loss and reduces the operating time. The proximal femur nail offers a stable fixation, minimizes the stress and allows early mobilization. It offers a superior stabilization than other currently used implants for such fracture. It is mandatory that the fracture must be reduced anatomically with alignment of postero-medial buttress before nail insertion as the nail does not do any spell. Though complications were reported, still it holds good, with good surgical hands because the procedure is technically demanding and needs a steep learning curve. Though the result in our study is promising, however it needs more evaluation, since the sample of study is small and it is non randomized.

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