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PROXIMAL FEMORAL NAILING VS DYNAMIC HIP SCREW FOR INTERTROCHANTERIC FRACTURES– A COMPARATIVE CLINICAL STUDY

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Abstract:

Intertrochanteric fractures are one of the common fractures encountered in today's orthopaedic practice. Over time, a number of implants have been used for the same. Multiple studies have been conducted in the past to study the advantages and disadvantages of the proximal femoral nail and the dynamic hip screw. However, the ideal choice of the implant remains a matter of debate. This study deals with the comparison of the Proximal femoral nailing (PFN) versus Dynamic hip screw (DHS) in treatment of Intertrochanteric fractures.

Methods: This study was conducted from October 2015 to August 2017. During this period 30 cases of adult patients with intertrochanteric fractures of femur were selected according to the inclusion criteria and classified according to the AO classification. Of the 30 cases, 16 were operated using a proximal femoral nail and 14 were operated using dynamic hip screw.

Aims: To assess the functional outcome and radiological outcome in cases of Intertrochanteric fractures treated with proximal femoral nailing and dynamic hip screw. And to study and compare the intra-operative parameters in both modes of treatment like duration, blood loss, radiological exposure.

Methods and Material: A prospective study was conducted from 2015 to 2017 during which 30 cases of Intertrochanteric fractures those fulfilled the inclusion criteria were operated either using Proximal femoral nailing or

dynamic hip screw. The choice of implant was chosen randomly. The AO/OTA classification system was used to classify the fractures.³

Conclusions: Our study shows that Proximal Femoral Nailing is a superior procedure in terms of lesser operative time, lesser blood loss, smaller incision, lesser post operative shortening but radiographic exposure is more compared to the Dynamic Hip Screw. Patient operated with PFN, being an intramedullary implant, can weight bear early as compared to those with DHS. However, long term results are equivalent for both. PFN is a more preferred implant for intertrochanteric fractures, especially for unstable pattern types. In cases of stable pattern fractures, PFN and DHS both have similar results.

Key words: Intertrochanteric fractures, Proximal Femoral Nailing, Dynamic Hip screw.

Introduction

Intertrochanteric fractures are the most common fractures occurring in the elderly¹. The incidence of Intertrochanteric fractures is on the rise and the incidence is estimated to be double by 2040¹. It occurs most commonly following trivial trauma in the elderly and following high velocity injuries in the young. They result in pain over the hip region, shortening and external rotation of the limb with inability to weight bear, thus ensuing the patient bed ridden. Therefore, the ultimate goal of management is ensuing early mobilisation and return the patient to pre-injury activity level as soon as possible². Though specific circumstances may necessitate conservative management, the standard mode of treatment is internal fixation of the fracture. There are various ways to achieve internal fixation. The two most commonly used implants are the proximal femoral nail and the dynamic hip screw. Each has its own merits and demerits³⁻⁶. There still remains unanimity regarding the ideal mode of treatment. The above study has been conducted to compare the clinical and radiological outcomes between these two modes of treatment.

Methodology

A prospective study was conducted from 2015 to 2017 during which 30 cases of Intertrochanteric fractures that fulfilled the inclusion criteria were operated either using Proximal femoral nailing or dynamic hip screw. The choice of implant was chosen randomly (every alternative patient). The AO/OTA classification system was used to classify the fractures.³

Inclusion Criteria

All patients with intertrochanteric femur fracture for whom surgical

intervention with PFN or DHS was planned.

Exclusion Criteria

Patients, otherwise meeting the inclusion criteria will be ineligible in case of any of the following criteria:

1. An earlier operation on the affected limb
2. Prior weakness in the affected limb due to any cause.
3. Pathological fractures
4. Severe osteoarthritis or arthritis causing dysfunction of the lower limbs
5. Neurologic disease causing impaired function of the lower limbs, including diabetic neuropathy
6. Psychiatric disorders
7. Poor General Condition
8. Age below 18yrs
9. Polytrauma
10. Individuals unable to give consent.

All the cases were pre-operatively subjected to a Pelvis with both hips (PBH) X-ray and a lateral hip X-ray of the affected limb. The pre-injury walking ability was assessed.⁴The patients were operated using a lateral approach with supine position on a traction table. Closed reduction and internal fixation easy done under image intensifier guidance.

Statistics: Qualitative data was presented as frequency and percentages and analysed using chi-square test or fisher's exact test (in case of 2x2 contingency tables). Quantitative data was presented as mean and SD and compared by unpaired t-test or Man Whitney U test (in case of non-normal distribution). The level of significance was set at $p=0.05$. We utilized SPSS 20.0 for Windows for all examinations.

Results

In our study of 30 cases of intertrochanteric fracture femur, 16 cases were operated by Proximal femoral nail and 14 cases were operated by Dynamic hip screw. Male to female ratio was almost equal with 16 males and 14 females. The most common age group was 61 to 70 years with the average age being 64 years. The minimum age was 25 years and maximum age was 78 years. The most common mode of injury was fall from height accounting for 46.7% of cases. AO 2.2 accounted for 43.3% of cases as per AO classification. Right sided injury was more common accounting for 53.3% of cases. 71.4% of the cases had unstable fracture pattern. 26 out of 30 patients had a grade 1 pre-injury walking ability. All patients were operated within 2 weeks of injury. The mean length of incision in cases of PFN was 7.95cms and that of DHS was 12.54cms. The mean blood loss in cases of PFN was 78.75ml and that of DHS was 117.14ml. The average duration of surgery in cases of PFN was 71.06 minutes and that of DHS was 75.86 minutes. The average radiographic exposure in PFN was 70.31 seconds while that of DHS was 56 seconds.

Majority of the patients were discharged by 5th or 6th day post-surgery. Mean period of full weight bearing was 16.86 weeks for DHS and 11.69 weeks for PFN.

50% of the patients operated by PFN had an excellent functional outcome and the other 50% had a good functional outcome based on the modified Harris hip score. In case of patients operated by DHS, 57.14% patients had an excellent outcome, 35.71% had a good functional outcome while 7.9% had a fair functional outcome.

No case operated by PFN developed varus alignment, whereas 2 out of the 14 cases of DHS (14.28%) developed varus malalignment.

8 of the 14 patients operated by DHS developed reduction of the neck shaft angle at the end of 1yr. Majority

of the patients operated by DHS had a decrease of 5 degrees at the end of 1yr. 5 of the 16 patients operated by PFN had decrease of the neck shaft angle.

10 out of the 14 cases of DHS developed some amount of shortening, while 9 of the 16 cases of PFN

developed some shortening. The mean shortening in the cases of PFN was 5.35mm and that of cases of DHS was 9.62mm.

All the patients had union at fracture site at the end of 1yr.

Intraoperative	Surgery		P value
	DHS	PFN	
Length Of Incision (cm)	12.54 ± 1.39	7.95 ± 0.75	0.0001
Duration (Mins)	75.86 ± 16.76	71.06 ± 13.19	0.38
Radiographic Exposure (seconds)	56 ± 9.9	70.31 ± 12.15	0.002
Blood Loss (ml)	117.14 ± 18.05	78.75 ± 19.87	0.0001

Table 1. Various Intraoperative parameters amongst different study population

As seen in the above table, the mean Length of Incision (cm), Duration of surgery (Mins) and Blood Loss was higher in DHS group as compared to PFN group. The mean Radiographic Exposure was significantly higher in PFN group as compared to DHS group. Length of Incision (cm) and Blood Loss was significantly higher in DHS group as compared to PFN group patients.

Postoperative	Surgery		P value
	DHS	PFN	
Duration Of Stay (days)	5.29 ± 1.1	4.69 ± 0.956	0.127
Mobilisation Partial Wt Bearing (weeks)	6.86 ± 1.23	5.75 ± 1.57	0.42
Mobilisation full weight bearing (weeks)	16.86 ± 3.4	11.69 ± 1.07	0.0001

Table 2. Various postoperative parameters amongst different study population

As seen in the above table, the patients operated with DHS were discharged later as compared to the patients operated with PFN. Patients operated by PFN could partially weight bear without pain earlier as compared to the patients operated by DHS. This was not significantly higher in the DHS group. However, patients operated by PFN could fully weight bear without pain at a significantly earlier time as compared to those operated by DHS.

Postoperative	Surgery		P value
	DHS	PFN	
1M MHHP	47.86 ± 3.6	47.94 ± 3.78	0.953421
3M MHHP	58.29 ± 4.5	61.81 ± 6.5	?
6M MHHP	72.71 ± 5.8	77.38 ± 2.6	0.00779
12M MHHP	86.93 ± 4.3	88.94 ± 2.3	0.117

Table 3. Postoperative modified Harris hip score amongst different study population

As seen in the above table, the mean modified Harris hip score was significantly higher in the PFN group as compared to the DHS group. However, by the end of 1 year, the results were not statically significant.

Score		DHS	PFN	Total
> 90	Excellent	8 (57.14%)	8 (50%)	16
80-89	Good	5 (35.71%)	8 (50%)	13
70-79	Fair	1 (7.14%)	0 (0%)	1
<70	Poor	0	0	0

Table 4. Functional outcome of Harris Hip Score

As seen in the above table, of 16 cases operated by PFN, 50% of the patients operated by PFN had an excellent outcome, whereas the other 50% had a good functional outcome. Of 14 cases operated by DHS, 57.14% had an excellent functional outcome, 35.71% had a good functional outcome while 7.14% had a fair functional outcome.

Postoperative	Surgery		P value
	DHS	PFN	
CDA	130 ± 1.6	130 ± 2.1	0.346
1M CDA	129 ± 1.8	130 ± 2.03	0.378
3M CDA	128 ± 1.6	129 ± 2.4	0.074
6M CDA	127 ± 2.5	129 ± 2.7	0.031
12M CDA	127 ± 3.41	129 ± 2.9	0.085

Table 5. Mean Cervicodiaphyseal angle amongst study population

Neck Shaft Angle	PFN	DHS
< 125 (Varus)	0	2
125 – 135	16	12
135 (Valgus)	0	0
Total	16	14

Table 6. Neck shaft angle amongst study population

As seen in the above table, there was no valgus/varus alignment observed in PFN group while in patients with

DHS group, 2 patients developed varus malalignment (14.28 %)

		Surgery		Total	
		DHS	PFN		
Reduction of CDA at the end of 1yr	0 degree	Count	6	11	17
		% within SURGERY	42.9%	68.8%	56.7%
	2 degree	Count	1	0	1
		% within SURGERY	7.1%	0.0%	3.3%
	3 degree	Count	1	2	3
		% within SURGERY	7.1%	12.5%	10.0%
	5 degree	Count	4	3	7
		% within SURGERY	28.6%	18.8%	23.3%
	6 degree	Count	1	0	1
		% within SURGERY	7.1%	0.0%	3.3%
	7 degree	Count	1	0	1
		% within SURGERY	7.1%	0.0%	3.3%
Total	Count	14	16	30	
	% within SURGERY	100.0%	100.0%	100.0%	

Table 8. Postoperative shortening at the end of 1 year amongst different study population

As seen in the above table, in DHS group shortening of limb at end of 1 year was observed in 71.4% while in PFN group it was present in 37.4%. The mean shortening in the DHS group was 0.94cm while in the PFN group the mean shortening was 0.39cm

Postoperative	Surgery		P value
	DHS	PFN	
Shortening of limb	0.94 ± 0.45	0.39 ± 0.13	0.012

Table 9. Mean Shortening of limb amongst different study population

As seen in the above table, the mean shortening was significantly higher in cases operated by DHS plating as compared to those operated by PFN.

Discussion

Intertrochanteric fractures account for approximately half of the hip fractures in elderly; out of this, more than 50% fractures are unstable.⁽⁵⁾ 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 in the last two decades and is currently considered as the standard device for comparison of outcomes. The DHS has been shown to produce good results but complications are

frequent, particularly in unstable intertrochanteric fracture. The advantage of Proximal Femur Nailing fixation is that it provides a more biomechanically stable construct by reducing the distance between hip joint and implant.

Most of patients in present study were from age group of 5th to 7th decade of life. The mean age in years for group operated by PFN was 64.81 ± 6.39 years while in DHS group it was 55.93 ± 14.73 years. This finding correlate well with the study conducted by Mayi SC et al 2016⁶ in which the mean age in PFN and DHS group was 50.06 ± 9.86 years and 52.46 ± 10.61

year respectively. Similarly, findings were observed by S.K. Venkatesh Gupta et al., 2015⁷ and Neil Rohra et al., 2016.⁸ The trochanteric region is the most common site of senile osteoporosis. As the age advances the space between bony trabeculae is enlarged and loaded with fat, whilst unsheathing compact tissue is thinned out and calcar is atrophied. Hip joint being a major joint in the mechanism of weight bearing, this already weakened part cannot withstand any sudden abnormal stress.

There was higher number of male patients (53.3%) as compared to female (46.7%). This finding correlate well with the study conducted by S.K. Venkatesh Gupta et al., 2015⁷ in which male contributes 76.56 % of the study population. Similarly finding were observed by Bhuvnesh Chaturvedi et al., 2015.⁹ Majority of the patients in the series were male as they are more outgoing and engaged in activities like agriculture, driving of motor vehicles and are more likely to be involved or prone to accidents/ fall. Females play a more dormant role and are involved more in household activities.

There was higher number of right sided involvement (53.3%) as compared to left sided involvement (46.7%). These findings are in agreement with the study conducted by Mayi SC et al., 2016.⁶

Fall was the most common mode of injury in patients with DHS group (50%) while fall and trivial fall was the most common mode of injury in patients with PFN group (43.8 each%). Similarly, in the study conducted by J. PAJARINEN et al 2003 in DHS group and PFN group fall was the mode of injury in 88.9% and 90.7% respectively. ⁹Similarly finding were observed by Mayi SC et al., 2016⁶. Horn & Wang (10) stated that mechanism of

injury is not direct but due to failure of Stress resisting forces during sudden bending or twisting. A direct blow on the lateral side of thigh would result in contusion, comminution on the lateral surface of the greater trochanter and cause valgus deformity.

AO type 2.2 (43.3%) was the most common type in patients with DHS group and PFN group followed by AO type 2.1 (23.3%) and type 2.3 (26.7%). Similarly, in the study conducted by Mayi SC et al., 2016, predominant fracture type in this study was A2.3 (53.12%) followed by AO type 2.2 (26.54%).⁶

According to Mervyn Evans the Inter trochanteric fractures are considered as stable or unstable depending upon integrity of posteromedial cortex. Fractures with intact posteromedial cortex are considered as stable fractures while fractures with loss of posteromedial cortex are considered as unstable fractures. Postero-medial cortex constitutes mainly the lesser trochanter.^{11,12}

Unstable fracture was present in 71.4 % of patients with DHS group while in PFN group it was present in 81.3% patients. Similarly, in the study conducted by UjjalBhakat et al., 2013, among the fracture, 31% were stable, 58% were unstable, 11% were reverse oblique fracture.¹³

Hypertension (16.7%) was the most common past illness followed by Diabetes only (10%) amongst study population. Similarly, findings were observed by Punit J. Tank et al., 2016.¹⁴This is associated with the general co-morbidities attributed to the older age group of patients.

The patients were not operated on an emergency basis. Patients were operated only when they were fully fit for surgery. All the patients were

operated using regional anaesthesia

In the present study, intra-operative complications like drill bit breakage, lateral cortex breach and lateral wall collapse was present in 7.1% each in patients with DHS group while in PFN group, no intraoperative complications were observed.

In DHS group most of the patients had 6 days of hospital stay (50%) with the mean duration of 5.29 ± 1.1 days while in PFN group most of the patients had 5 days of hospital stay (62.5%) with the mean duration of 4.69 ± 0.956 days. This finding is in agreement with the study conducted by J. Pajarinen., 2003 in which the mean duration of hospitalization (days) in DHS and PFN group was 5.4 ± 3.0 and 6.1 ± 3.3 respectively.⁹ This is attributed to decrease in pain at the affected site after surgery and the ability to sit and mobilize with the help of support.

In DHS group shortening of limb at end of 1 year was observed in 71.4% while in PFN group it was present in 37.4%. The mean Shortening of limb was significantly higher in DHS group (0.94 ± 0.45 cm) as compared to PFN group (0.39 ± 0.13) at the end of follow up at 6 month. This finding correlate well with the study conducted by Mayi SC et al 2016 in which mean shortening of the affected limb in DHS group was 1.55 ± 0.49 cm as compared with 1.21 ± 0.74 cm in PFN group.⁶ Similarly in the study conducted by Ujjal Bhakat et al., 2013., The average shortening in the P.F.N group was 5.35 mm as compared to 9.62 mm in the D.H.S group¹³. Shortening can be attributed to the collapse of the proximal fragment into the distal fragment and is observed at a greater frequency in unstable fractures. It is also attributed to varus angulation of the neck of femur.

The mean Length of Incision (cm), Duration of surgery (Minutes) and Blood Loss was higher in DHS group as compared to PFN group. As the incisions taken in PFN are smaller, the mean blood loss was relatively less. However meticulous dissection while exposure in cases of DHS, with elevation of vastuslateralis and proper care not to damage the perforator vessels results in less blood loss. This findings is in agreement with the study conducted by S.K. Venkatesh Gupta et al.,⁷ in which the Total duration of surgery and Length of Incision (cm) was significantly higher in DHS group than it was in PFN group, Similarly in the study conducted by Mayi SC et al., 2016.⁶ the blood loss was higher in DHS group as compared to PFN. Similar findings were observed in Taeger G et al (¹⁵) and Muzaffar N et al.¹⁶.

The mean radiographic exposure in cases of PFN was significantly higher in cases of PFN as compared to the exposure in cases of DHS. Proximal femoral nailing is a relatively recent procedure and requires a higher level of skills and practice and the incision and exposure being relatively small, there is greater dependence on radiographic aids to ensure correct placement of implants.

The mean Duration of hospital Stay and Mobilisation Partial Weight Bearing was higher in DHS group as compared to PFN group though statistically not significant. While Mobilisation Unaided was significantly higher in DHS group as compared to PFN group. Similarly in the study conducted by BhuvneshChaturvedi et al., period of hospital stay was almost the same in DHS and PFN group and was statistically insignificant.⁽⁹⁾. Similarly in the study conducted by Mayi SC et al., 2016 the weight bearing

was started late in patients treated with DHS as compared to patients treated with PFN.⁶

The mean Visual analogue score was higher in DHS group as compared to PFN group at the end of follow up at 6 months though statistically not significant.

The mean modified Harris hip score was significantly higher in PFN group as compared to DHS group at the end of follow up at 6 months, but not significantly higher at the end of 1 year. Harris Hip score was good in 64.3%, Excellent in 28.6% and fair in 7.1% in DHS group while in PFN group it was good in 62.5%, Excellent in 31.3% and fair in 6.3%. Similarly in the study conducted by Ujjal Bhakat et al., 2013.⁷ 6 month hip score in DHS (mean = 78.8) was also less than that of PFN (mean = 82.8). Similarly, in the study conducted by Mayi SC et al., 2016⁽⁶⁾ functional outcome was better in patients treated with PFN compared to the patients treated with DHS in the initial 6 months of postoperative period. Similar findings was observed by Pajarinen J et al.,⁹ At the end of 1 year, both groups of patients had a similar functional outcome as per Harris Hip Scoring.

There was no valgus or varus alignment observed in PFN group while in patients with DHS group, 2 patients developed varus malalignment 2 (14.28 %). Similarly, in the study conducted by Ujjal Bhakat et al., 2013,¹³ There was varus angulation in 2 patients (6.66%) of DHS group. Varus alignment is more common in cases of unstable fractures operated by DHS. Deficient lateral wall integrity leads to uncontrolled collapse of the proximal fragment thus may lead to varus alignment.

At the end of 1 year, all the patients

in our study had signs of union of fracture site. The union was confirmed radiographically on the basis of callus formation at fracture site and clinically based on absence of pain and tenderness.

No mortality was observed in any of the patients.

Conclusion

Based on our results; PFN appears to be a superior procedure in terms of lesser operative time, lesser blood loss, smaller incision, lesser post operative shortening but radiographic exposure is more compared to the DHS. Patients operated by PFN could fully weight bear without pain at significantly earlier as compared to those operated by DHS. However, after a period of about 1 year, there is no significant difference in the clinical outcomes. PFN is a more preferred implant for intertrochanteric fractures, especially for unstable pattern types. In cases of stable pattern fractures, PFN and DHS both have equivalent results. With experience and better understanding of the procedure, PFN can be used as the implant of choice for unstable as well as stable intertrochanteric fractures.

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