ORIGINAL RESEARCH PAPER

Orthopaedics

DYNAMIC HIP SCREW VS PROXIMAL FEMORAL NAIL IN SURGICAL MANAGEMENT OF TROCHANTERIC FRACTURES: A PROSPECTIVE COMPARATIVE STUDY

KEY WORDS: Trochanteric fracture, Dynamic hip screw, proximal femoral nail, hip fracture

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ABSTRACT

Introduction: Trochanteric fractures are the commonest hip fractures specially in elderly. Present study aimed to evaluate and compare the operative characteristics, radiological and functional outcome and incidence of complications with Dynamic Hip screw (DHS) and proximal Femoral Nail (PFN) used in surgical correction of Trochanteric fractures.

Material and Methods: A Randomized comparative study was conducted at department of orthopaedics, at a tertiary care centre of Northern India. Thirty patients of with trochanteric fractureswere randomized to eitherDHS or PFN group. Follow up evaluation was done at 1, 3 and 6 months. Functional outcome was assessed using 'Harris hip score'.

Results: Mean age of patients was 62.47±20.73 years. Fall was responsible for 56.7% of fractures. Mean Operating time ($p<0.001$), blood loss ($p=0.004$), radiation exposure ($p=0.025$) and mean duration of hospital stay were significantly more in DHS group. Callus at 3 cortex was seen in more subjects in PFN group (93.33%) as compared to DHS group (53.33%) at one month, however all patients in both group had callus formation at 3 months. Pain score was significantly less in PFN group at 1 & 3 months follow up. All patients in PFN group were able to walk without support at 3 months, whereas only 10 (66.7%) patients did so in DHS group. Harris Hip score was significantly higher in PFN at one month. Time to return to work was significantly less in PFN group.Incidence of infection, varus deformity and limb length disparity was more with DHS.

Conclusion: Though PFN had operative and early post operative advantages, final success rate at 6 months was similar in both groups. Choice between the two methods needs to be individualized considering their merits and demerits.

INTRODUCTION:

Trochanteric fractures constitute nearly half of the Hip fractures commonly occurring in elderly, but in Indian scenario it is also becoming common in younger patients because of high incidence of road traffic accidents.[1]Primary goal of treatment of trochanteric fracture is early mobilization to reduce morbidity and mortality, specially in geriatric patients.[2]Earlier, Trochanteric fractures were managed conservatively till fracture healed (usually 10 – 12 weeks), followed by a lengthy ambulation trainingprogramme; leading to high complication rates included Decubitus ulcers, Urinary tract infection, Joint contractures, Pneumonia and Thromboembolic complications and high mortality rate[2]. Even healed fracture was associated withvarus deformity and shortening due to absence of traction to counter the deforming muscular force. All these in addition to poor and delayed functional recovery lead to high cost of care after injury.[3]

Even after introduction of surgical treatment, for many decades, there has been no significant improvement in mortality or functional recoveryprobably due to false assumptions like acceptance of uncontrolled shortening, varus collapse, acceptance of non anatomical reduction, and treating these fractures in isolation without considering management of the patient as whole.[4]More than half of the Intertrochanteric fractures in elderly are unstable fractures andrestoration of mobility in depends to a great extent on the success of surgical correction.[5]

Both intramedullary fixation and dynamic hip screw are being used in trochanteric hip fractures. Different types of intramedullary nails have been used for stable fixation and early mobilization of trochanteric fractures. Proximal femoral nail (PFN) provided good results in per-, inter- or subtrochanteric femoral fractures.[6] Possible advantage of intramedullary fixation is by reducing the distance between the hip joint and theimplant,a more biomechanically stable construct is achieved;However there is risk of jamming of the sliding mechanism and stress risers at the location of tip of the nail and distal locking bolts.[7]

Use of locking Dynamic hip Screw (DHS)in inter-trochanteric fracture results ingood bone healing without any major complications, although improper fixation techniques may result in higher failure rate with the implant.[8]The advantages of intramedullary fixation of trochanteric hip fractures over dynamic screw plate devices are still a matter of debate.Thus this study aimed to evaluate and compare intra-operative characteristics, functional outcomes and complications with PFN and DHS in management of trochanteric fractures.

MATERIAL AND METHODS:

ARandomized comparative study was conducted at department of orthopaedics, at a Medical college associated tertiary care centre of Northern India. Thirty patients of either gender with trochanteric fractures, admitted in Orthopedic Wards from January 2017 to June 2018were included in the study. Patients, who were Skeletal immature, not fit for Spinal or general anesthesia due to any reason, had any other limb pathology, peripheral vascular study or had fracture shaft femur or intra-capsular fractures of femur neck were excluded from the study. Eligible patients were recruited consecutively into the study and these patients were randomly divided into two groups using Block randomization method:

Group I (n=15) - Patients were managed with Dynamic Hip Screw (DHS).

Group II (n=15) - Patients were managed with Proximal Femoral Nail (PFN).

Ethical clearance was obtained from 'Institutes Ethical Committee' prior to initiation of study. Written informed consent was obtained from all subjects prior to inclusion in the study. Information from study subjects was collected using a pre designed semi structured questionnaire. Information was collected regarding socio demographic characteristics, injury characteristics and clinical features andother co-morbidities, operative characteristics, intra and post op complications. All patients were managed under similar conditions using the same standard protocol during the pre/intra/post op period.

The fracture was reduced by traction in neutral, slight internal

or external rotation depending on the nature of the fracture and checked by antero-posterior and lateral views on the image intensifier. All fractures were reduced by the closed method. Fixation using Dynamic Hip Screw or Proximal Femoral Nail was done using the same technique, following the same standard procedure under similar operative conditions.

Post-operative, Early Mobilization was done after 48 hours and Weight bearing to tolerance was started using a walking frame, depending to the patient's condition and stability of internal fixation. Functional and radiological (x-rays) follow up were done at 1, 3 and 6 month for the signs of fracture union. Callus in atleast 3 cortex was considered radiological union. No callus formation even after 6 months in any of the cortex was considered as Non-union. Clinical union was considered when patient was able to walk without support & without pain.Visual analogue score was used for pain evaluation. Functional outcome was assessed using 'Harris hip score'.It includes 3 sectionsandis interpreted as Excellent (score 90 - 100), Good (score 80 - 89), Fair (score 70 - 79) and Poor (score < 70).

STATISTICAL ANALYSIS:

Categorical variables were expressed as frequency and percentage and were analyzed using Chi square test / Fischer Exact test as applicable. Continuous variables were expressed as mean and standard deviation and were analyzed using t test, while ordinal variables were analyzed using Mann Whitney Rank Sum Test. A p value < 0.05 was taken as statistically significant. All statistical analyses was done using 'Epi info version 7.2.1.0'.

RESULTS:

Most patients were aged >40 years (66.7%) with mean age of 62.47±20.73 years with male & females almost equal in number. Fall was responsible for more than half of the fractures (56.7%). Most fractures were stable fractures (63.3%). Both the groups were similar in relation to their baseline characteristics like age, gender, occupation, mode of injury and fracture characteristics (Table 1).Operating time was significantly longer in DHS group (p<0.001) and mean blood loss(p=0.004), radiation exposure (p=0.025) and mean duration of hospital stay were also significantly more in DHS as compared to PFN group (Table 2).

Callus at 3 cortex was formed in significantly more subjects in PFN group (93.33%) as compared to DHS group (53.33%) after one month, however all patients in both group had callus formation at 3 months follow up. Pain score was significantly more in DHS group at 1 & 3 months follow up. All patients in PFN group were able to walk without support at 3 months, whereas only 10 patients did so in DHS group. Harris Hip score was significantlyhigher in PFN at one month follow up.Time to return to work was significantly less in PFN group as compared to DHS group (Table 3).Though incidence of complication like infection, varus deformity and limb length disparity was more with DHS, this difference was not statistically significant.

Table 1: Baseline Characteristics of study groups

Variable		CRIF with DHS	CRIF with PFN	P value
Age (years)		59.87 ± 20.26	65.07 ± 21.57	0.147
Gender	Male	8 (53.3%)	8 (53.3%)	1.000
	Female	7 (46.7%)	7 (46.7%)	
Occupation	Sedentary	3 (20%)	4 (26.7%)	0.890
	Moderate	6 (40%)	5 (33.3%)	
	Strenuous	6 (40%)	6 (40%)	
Limb affected	Left	7 (46.7%)	6 (40%)	1.000
	Right	8 (53.3%)	9 (60%)	
Mode of injury	Fall	10 (66.7%)	7 (46.7%)	0.462
	RTA	5 (33.3%)	8 (53.3%)	
Fracture type (stability)	Stable IT	7 (46.7%)	5 (33.3%)	0.701
	Unstable IT	8 (53.3%)	10 (66.7%)	
AO Fracture classification	31A1	7 (46.7%)	4 (26.7%)	0.094
	31A2	7 (46.7%)	5 (33.3%)	
	31A3	1 (6.6%)	6 (40%)	
Time lag between injury & surgery	5-7 days	9 (60%)	7 (46.7%)	0.632
	8-10 days	4 (26.7%)	4 (26.7%)	
	> 10 days	2 (13.3%)	4 (26.7%)	

Table 2: Comparison of operative Characteristics of study groups

Variable		CRIF with DHS	CRIF with PFN	P value
Operating time	(in minutes)	86.7 ± 9.5	68.4 ± 10	<0.001
Blood loss	(in ml)	163 ± 58.5	97.5 ± 54.4	0.004
Radiation exposure (No. of shots)*	< 100	12 (80%)	3 (20%)	0.003
	≥ 100	3 (20%)	12 (80%)	
Duration of stay (days)	< 7 days	5 (33.3%)	12 (80%)	0.025
	≥ 7 days	10 (66.7%)	3 (20%)	

*Radiation exposure was measured in terms of shots taken with Image Intensifier

Table 3 : Comparison of radiological and functional outcome among study groups

Variable	Follow up	CRIF with DHS	CRIF with PFN	P value
Callus at 3 cortex	1 month	8 (53.33%)	14 (93.33%)	0.035
	3 month	15 (100%)	15 (100%)	-
	6 month	15 (100%)	15 (100%)	-
VAS score	1 month	4.67 ± 1.29	3.47 ± 0.83	0.015
	3 month	2.47 ± 1.13	1.20 ± 0.94	0.007
	6 month	0.20 ± 0.56	0.07 ± 0.26	0.753
Ability to walk without support	1 month	9 (60%)	10 (66.7%)	1.000
	3 month	10 (66.7%)	15 (100%)	0.042
	6 month	15 (100%)	15 (100%)	-
Harris Hip score	1 month	71.93 ± 8.60	78.87 ± 7.74	0.028
	3 month	83.13 ± 7.04	84.73 ± 4.76	0.756
	6 month	91.73 ± 5.16	91.47 ± 5.07	0.885
Time to return to work (weeks)		36.67 ± 5.63	24.47 ± 3.80	<0.001

Table 4 : Comparison of complications among study groups

Follow up time	Complications	CRIF with DHS		CRIF with PFN		P value
		N	%	N	%	
1 month	Infection	4	26.67	1	6.67	0.330
6 month	Varus Deformity	2	13.33	1	6.67	1.000
6 month	Limb length disparity	2	13.33	1	6.67	1.000

DISCUSSION:

Increasing life expectancy and incidence of Road traffic accidents have lead to increasing incidence of trochanteric fractureswhich have remained an uphill challenge for orthopaedicianssince long time. In present study, troch anteric fracture was more common in elderly with mean age of patients being 62.47 years. Mean age of 60-72 years had been reported by Cyril J etal[9], Kumar R et al[10]&H Naushad et al[11] in accordance to present study.Trocantri fractures were slightly more common in males (53.3%) probably because males report more outdoor activities as was similarly reported by Cyril J etal[9] andSharma H et al[12].Fall (56.7%) was the most common mode of injury in present study. Other

Studies by Cyril J etal[9], Kumar R et al[10]and Jose A et al[13]also reported fall as most common cause. Old age people are prone to fracture by trivial trauma like fall because of Osteoporotic bones.

More than 3/4th patients had31A1or 31A2 type fracture according to AO classification which is in concordance with findings of Yadav S etal[14](2016).In present study nearly half patients were operated after a delay of atleast 7 days**.** Similar delay was reported bySelvametal[1](2018).Contrary to this,Sharma H etal[12] (2015)reported surgery in as soon as patients presented to hospital and were fit for surgery. This could be better for a quick postoperative recovery period. The mean operation time was significantly morefor DHSas compared to PFN. This isin comparison to results ofN. Selvametal[1](2018) and Cyril J et al[9](2016). In present study the mean blood loss was significantly more for DHS as compared to PFN. Similar findings were reported byKumar R etal[10] and Sharma A etal[15]with even more amount of blood loss in DHS group. DHS requires an extensive operative field for better exposure, hence longer operative time and more blood loss.

Radiation exposure with Image Intensifier was more for PFN group as compared to DHS, though not statistically significant, it was in accordance with various studies like Kumar R et al[10] (2012), Loomba et al[16] (2015), Jose A et al[13] (2017), Sharma A et al[15](2017).PFNbeing an intramedullary implant requires greater precision and technical knowhow requiring more number of imaging, hence radiation exposure.In present study, mean hospital stay was significantly longer in DHS group(11.47 days)as compared to PFN (7.27 days). This supportsPFN's claim of being a better implant as it reduces the chances of hospital acquired infection and lesser financial burden due to shorter hospital stay. Contrary to this N. Selvametal[1]reported no significant difference in hospital stay of both groups probably due to different protocol of hospital discharge after surgery.

Comparing three cortex callus formation,PFN showed better results in early post operative period, but both groupsl evelled out at subsequent follow ups at 3 and 6 months.Cyril J et al[9](2016) also found callus formation to be better in PFN in early post operative period and eventually similar callus formation in both PFN and DHS.This differencecould have been due to patient factors like general health, better nutrition and younger age that were not accounted for. Patients were able to walk without support earlier in PFN group as compared to DHS group, indicating that PFN takes priority over DHS in early post operative period, however all patients in both groups were able to walk without support at 6 months follow up.

In present study time to return to work was significantly less in PFN. N. Selvametal[1]however foundno significant difference in resumption of work in the two group probably because of different patient characteristics like occupation. Incidence of suture site infection was more in patients who underwent CRIF with DHS(26.67 %) as compared to CRIF with PFN (6.67%), but the difference was not statistically significant. Higher rate of infection with DHS can be attributed to the longer suture line. Similar findings were reported byCyril J etal[9]and N. Selvametal[1]. Varus deformity and limb length discrepancy were seen in 2 patients who underwentCRIF with DHS and only one patient in CRIF with PFN. Similar finding with negligible difference were found by Sharma A etal[15].

In the present study, Pain Score (VAS) was significantly higher for DHS compared to PFN (3.47) at 1 & 3 month follow upindicating PFN to be better in early post-operative period. Mean Harris hip score was significantly higher with PFN group (78.87) when compared to DHS at one month follow-up indicating early function recovery with PFN. This as similar to thatreported byCyril J et al[9] (2016), Hussain N et al[11] (2018) and Bakshi A et al[16] (2017).

CONCLUSION:

Final success rate was similar with both Dynamic Hip Screw and Proximal Femoral Nail with no patient reporting non union at 6 months or requiring re surgery.Both implants have their own merits and demerits and it would be difficult to proclaim superiority for either one. PFN However had advantage over DHS in terms of shorter operative time and lesser blood loss and shorter duration of hospital stay. PFN also had early post operative advantage of better radiological and functional outcome and early return to work. However, PFN requires higher precision and minor deviations can cause loosening of the implants and failure of surgery. Hence choice of DHS or PFN could be individualized for a patient considering these above characteristics.

Conflict of Interest: None

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