

MINIMAL INVASIVE DYNAMIC HIP SCREW VERSUS PROXIMAL FEMORAL NAILING IN TREATMENT OF INTER- TROCHANTERIC FRACTURES- A COMPARATIVE STUDY

Research Article Orthopaedics

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Abstract:

Background: Inter-trochanteric fractures can be managed efficiently by fixation with Proximal femoral nail (PFN) which is intramedullary and has advantages like maintaining controlled impaction, lower rates of implant failure, shortening and deformity, shorter operative time, less soft tissue dissection and bleeding compared to fixation using Dynamic Hip Screw (DHS).

Objective: To compare the surgical outcomes of Internal fixation with Proximal femoral nail with Dynamic Hip Screw in patients with Inter-trochanteric fractures.

Methodology: This prospective comparative study was conducted at Puducherry from May 2015 to May 2017 among 30 adult patients of Inter-trochanteric fractures of femur randomly allocated for either of the two operative procedures viz: internal fixation with Proximal Femoral nail (15 cases) and Minimal invasive Dynamic Hip screw (15 cases). The surgical outcomes were compared in terms of intra-operative and post-operative variables as well as delayed outcomes during follow-up till radiological bone union was documented.

Results: The mean age of the study participants was 55.7 ± 2.7 years and majority (53.3%) was females. The mean duration of surgery was shorter (52.1 minutes in PFN versus 69.9 minutes in DHS), mean blood loss was

minimal (97.5 ml versus 163 ml), mean duration of stay in hospital was less (16.2 days versus 16.8 days), time of weight bearing was faster (3.6 weeks versus 9.5 weeks) and mean duration of fracture union was shorter (15.2 weeks versus 19.9 weeks) in PFN compared to DHS.

Conclusion: The fixation of inter-trochanteric fractures with PFN is a better operative procedure compared to DHS in terms of reduced operating time, minimal blood loss, higher stability, early mobility, less morbidity and favorable outcomes both anatomically and functionally.

Keywords: Proximal femoral nail (PFN), Dynamic Hip Screw (DHS), Inter-trochanteric fractures

Introduction

Inter-trochanteric fractures occur more commonly in the elderly age group with an overall preponderance ratio of 9:1 compared to the younger age group.^{1,2} In the era before 1960, it was suggested to manage such fractures conservatively which resulted in various complications like infections, thrombo-embolisms and a mortality rate of 15-20%.^{3,4} With the advent of modern methods for fixation of fractures, conservative treatment is a choice only for a rare group with chronic debilitating conditions, unfit for surgery.⁴

Among the operative fixation techniques for inter-trochanteric (IT) fractures, the extramedullary sliding Dynamic hip screw (DHS) with barrel side plate is more commonly used. DHS is non-collapsible and allows the proximal fragment to settle over and thereby seeking its own position of stability. However there are disadvantages like large skin incision and more soft tissue dissection with greater blood loss associated with this procedure.⁵

On the other hand, Proximal femoral nail (PFN), being intramedullary with a shorter lever arm has advantages like maintaining controlled impaction, lower rates of implant failure, shortening and deformity, shorter operative time, less soft tissue dissection and bleeding.⁶

Hence this study was designed aiming to compare the outcomes of the above procedures and declaring the efficient between the two.

Methodology

This prospective comparative study was conducted in Sri Venkateshwaraa Medical College Hospital & Research Centre, Ariyur, Puducherry, from May 2015 to May 2017 among 30 adult

patients of Inter-trochanteric fractures of femur. The patients were initially evaluated pre-operatively and then randomly allocated for either of the two operative procedures viz: internal fixation with Proximal Femoral nail (15 cases) and Minimal invasive Dynamic Hip screw (15 cases). Participants included in the study were patients aged 18 years and above with inter-trochanteric fractures of less than two weeks old. Demographic details, mode of trauma, type of fracture, type of surgery, intra operative and post operative complications, follow up examination including hip joint examination, duration of full weight bearing were collected and recorded in a proforma. Patients admitted with pathologic fractures other than osteoporosis, polytrauma and cancer patients who are on chemotherapy or irradiation treatment were excluded from the study.

Operative procedure:

Informed written consent was obtained from all the study participants after explaining the details of the procedure in the local language of the patient. Patients were evaluated clinically and radiologically after necessary emergency management and splintage with skeletal traction. The patients were subjected to pre-operative anesthetic risk assessment, needful medical management and preferable timing for surgical management was fixed accordingly. All included subjects were operated electively on a standard fracture table under spinal anesthesia with C-arm guidance.

Proximal femoral nail made up of AISI 316 L stainless steel and of standard length 250 mm was used in our study. The proximal diameter of nail was 14 mm with two slots for a

proximal de-rotation screw of 6.5 mm and distal lag screw of 8 mm. Distal locking, if necessary was done with self tapping, cortical screws, 4.9 mm, one in static and the other in dynamic mode permitting 5 mm dynamization around the axis. The nail was fixed with a neck shaft angle of 135 degrees and 6 degrees of medio-lateral valgus angulation.

Richard's dynamic compression lag screw of length 50-110 mm, with threaded distal portion of 12.7 mm diameter and proximal unthreaded portion (shaft) of diameter 8.7 mm was used for DHS fixation. It was cannulated to accept a 3.2 mm guide wire. The lag screw was inserted into the barrel of side plate into which it can slide. The groove in the shank of the lag screw, which corresponds to the key in the barrel, prevents the rotation. The side plate (4 or 5 holed plate) accommodates 4.5 mm cortical bone screws.



Figure 1: a- Dynamic hip screw, b- Proximal femoral nail

Post-operatively, the operated limb was elevated for a day and IV fluid management was maintained till the patient was compliant to feed orally. Intravenous broad spectrum antibiotics were administered for 5 days and then converted to oral antibiotics. Patient was encouraged to do static quadriceps exercises on 2nd post-operative day followed by active quadriceps exercises and hip flexion exercises on 4th or 5th post operative day. Patient was ambulated non-weight bearing with axillary crutches. Sutures were removed on 12th post-operative

day. Partial weight bearing was started after the fracture site was assessed clinically and radiologically at 6 weeks post operatively. Full weight bearing allowed only after the confirmation of radiological and clinical union.

Follow-up

Following discharge of the patient, regular follow up evaluations were done at 2 weeks, 1 month, 2 month and every month until fracture unites. At each visit the implant position, change in fracture alignment, fracture union and functional recovery was noted and entered in the proforma. Modified hip score was used for evaluation. A score of less than 70 was considered poor, 70-79 as fair, 80-89 as good and 90-100 as excellent outcomes following surgery.^{7,8}

Statistical analysis

Data was entered in Microsoft Excel and statistically analyzed by the SPSS (Statistical Package for the Social Sciences) version: 20. Relationship between various categorical variables was tested by Chi- Square test. A p-value of less than 0.05 was taken as statistically significant within 95% confidence limits.

Results

The study included 30 participants with inter-trochanteric fracture randomly allocated for two procedures viz: 15 patients underwent fixation with Proximal Femoral nail and the other 15 patients fixed using Minimal invasive Dynamic Hip screw. The demographic and clinical profile of the study participants is mentioned in Table 1.

Table 1:
Demographic and clinical characteristics of the study participants [n=30]

Variables	Type of surgery		Total (N=30)	p-value*
	DHS (n=15)	PFN (n=15)		
Age (Years)				
18-40	2 (13.3)	3 (10)	5 (16.7)	0.73
41-60	6 (40)	7 (46.7)	13 (43.3)	
60-80	7 (46.7)	5 (33.3)	12 (40)	
Gender				
Male	6 (40)	8 (53.3)	14 (46.7)	0.71
Female	9 (60)	7 (46.7)	16 (53.3)	
Side of injury				
Right	4 (26.7)	7 (46.7)	11(36.7)	0.44
Left	11 (73.3)	8 (53.3)	19 (63.3)	
Type of Fracture				
Type 1 Fracture	5 (33.3)	5 (33.3)	10 (33.3)	0.99
Type 2 Fracture	8 (53.3)	7 (46.7)	15 (50.0)	
Type 3 Fracture	2 (13.4)	3 (20.0)	5 (16.7)	

Figure in () indicate column percentage *Chi-square test

The outcomes of both types of surgery were compared [Table 2] and the most of the outcome parameters were comparatively better in the PFN group compared to the DHS fixation group. The incidence of delayed complications of fracture healing was also nil in both types of surgeries.

Table 2:
Comparison of outcomes of fixation with DHS and PFN (N=30)

Outcomes	Type of surgery	
	DHS (n=15)	PFN (n=15)
Intra-operative		
Mean time of operation after fracture (in days)	7.2	5.8
Mean duration of operation (in minutes)	69.9	52.1
Mean blood loss (in ml)	163	97.5
Mean length of incision (in cm)	9.1	5.6
Mean length of lag screw (in mm)	84.5	86
Post-operative		
Mean duration of stay in hospital (days)	16.8	16.2
Time of weight bearing (in weeks)	9.5	3.6
Radiological union		
Mean duration of fracture union (in weeks)	19.9	15.2
Clinical assessment of outcome		
Mean Harris Hip score at 6 weeks	69.34	81.23
Mean Harris Hip Score at 20 weeks	80.2	83.57

Discussion

The management of inter-trochanteric fractures has not yet attained an ideal surgical technique of complete safety and guaranteed results. In 1990, PFN became more popular, almost pushing back DHS, due to its biomechanical advantages. Yet, it faced mechanical failures too in later years.^{9,10} Herman *et al.*¹¹ proposed that fixing the screws in the safe zone can reduce the incidence of mechanical failures associated with PFN fixation. The safety and reliability thus even depends on the skill of the maneuvering surgeon and is a confounder in establishing association between use of PFN and mechanical failures.

The mean age of the study participants was 55.7 ± 2.7 years and majority (53.3%) were females showing the importance of post-menopausal osteoporosis in the incidence of inter-trochanteric fractures. However strong evidence of association between post-menopausal osteoporosis and inter-trochanteric fractures could not be established as it was beyond the scope of the study. A similar study done by Jonnes *et al.*¹² showed that majority (53%) was males and females were comparatively less (47%). Thus this makes the confounder post-menopausal osteoporosis weaker as an influencing factor.

In the present study, major proportion (63.3%) of the inter-trochanteric fractures was on the left side which was attributable to left side being the non-dominant side (all participants were right-handers). [Table 1] This was supported by the study done by Kumar *et al.*¹³ in which left side (29 cases) had more incident IT fractures than right side (21 cases).

Suranigi *et al.*¹⁴ documented that the type II Boyd and Griffin fractures

were most common type of fracture in their study which was confirmed in our study also showing half (50%) of the participants had type II fractures.

In this study, the mean duration of operation [Table 2] taken for PFN was 52.1 minutes and for DHS it was 69.9 minutes. In contrast, the average time taken was 90 minutes and 80 for PFN and DHS respectively in a study done by Mundla *et al.*¹⁵ The study also documented more radiation exposure (60 seconds) in PFN compared to DHS. There was no such documentation in the present study as both had similar duration. Blood loss during surgery was higher in DHS (163 ml) in our study and it was similar to the above study.

Mean duration of stay in hospital in our study was 16.8 days for DHS and 16.2 days for PFN. This was similar to the studies done by Bhatti *et al.*¹⁶ and Mundla *et al.*¹⁵

Previous studies¹⁴⁻¹⁶ documented earlier full weight bearing in PFN at 10.6 weeks compared to 14.8 weeks in PFN group¹⁵ Similar results were observed in the present study also as PFN had earlier mobilization at 3.6 weeks in PFN group compared to DHS.

Conclusion

The study clearly delineated that PFN is a better operative procedure for Inter-trochanteric fractures compared to DHS in terms of reduced operating time, minimal blood loss, higher stability, early mobility, less morbidity and favorable outcomes both anatomically and functionally. Hence it can be recommended as a procedure of choice for elderly osteoporotic with inter-trochanteric fractures.

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