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Dr. Hari Prasath T
Senior Resident, Central
Institute of Orthopaedics,
VMMC and Safdarjung Hospital,
New Delhi, India

Dr. Laxmish R
Senior Resident, Central
Institute of Orthopaedics,
VMMC and Safdarjung Hospital,
New Delhi, India

Dr. Narendra Kumar
Professor, Central Institute of
Orthopaedics, VMMC and
Safdarjung Hospital, New Delhi,
India

Functional outcome of proximal femoral nailing (PFN) versus dimon hughston osteotomy with dynamic hip screw (DHS) fixation in unstable intertrochanteric femur fractures

Dr. Hari Prasath T, Dr. Laxmish R and Dr. Narendra Kumar

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Abstract

Intertrochanteric fracture is one of the most common fractures of the hip especially in the elderly with osteoporotic bones, usually due to low energy trauma like simple falls. The goal of the treatment of these fractures is stable fixation, which allows early mobilization of the patient. This study was conducted to compare the functional and radiological outcome of proximal femoral nailing and Dimon Hughston Osteotomy with Dynamic Hip Screw (DHS) fixation in treatment of unstable intertrochanteric femur fractures amongst 60 patients, with 30 patients in each group. In our study we found that patients treated with DHS group showed better results in comparing PFN in terms of early weight bearing, functional outcome, early radiological union but had its own complications. Both are effective in the treatment of unstable intertrochanteric fractures, it is the fracture geometry and bone quality which will influence the choice of fixation.

Keywords: Proximal femoral nailing, dimon hughston osteotomy, intertrochanteric femur fractures

Introduction

Intertrochanteric femur 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”. Any medical condition associated with bone loss like Diabetes mellitus, Hyperparathyroidism, Hyperthyroidism and Cushing’s syndrome is associated with a 27 fold rise in the risk of 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.

Hip fractures includes trochanteric and femoral neck fractures. Surgical treatment with stable fixation allows early mobilization and reduces complications. There are two main types of fixation for trochanteric fractures which are plate fixation and intramedullary implants. The Proximal femoral nail has become prevalent in treating trochanteric fractures in recent years. The incidence of intertrochanteric fractures has been increasing significantly due to the rising age of modern human populations. Generally intramedullary fixation and extramedullary fixation are the two primary options for treatment of such fractures. The Dynamic Hip Screw commonly used in extramedullary fixation has become a standard implant in treatment of these fractures.

Proximal Femoral Nail (PFN) uses 2 implant screws for fixation into the femoral head and neck. The larger femoral neck screw is intended to carry most of the load. The smaller hip pin is inserted to provide rotational stability. Biomechanical analysis of PFN showed a significant reduction of distal stress and has become prevalent in treatment of intertrochanteric fractures in recent years. Despite the mechanical advantage of PFN, lag screw cut out remains a significant problem, especially in the more unstable fractures.

Corresponding Author:
Dr. Laxmish R
Senior Resident, Central
Institute of Orthopaedics,
VMMC and Safdarjung Hospital,
New Delhi, India

Aufranc *et al.* (1962) introduced the concept of formal medial displacement osteotomy with impaction of the fracture fragment in the management of the unstable intertrochanteric fractures. In 1965 Dimon and Hughston reported the use of a medial displacement osteotomy in the treatment of comminuted intertrochanteric fractures to produce a stable configuration whereby collapse of the fracture into varus with subsequent extrusion of the fixation device was prevented.

Dimon and Hughston described medial displacement osteotomy in which the distal fragment is displaced medially under the head neck fragment and the spike of the proximal fragment is inserted into the distal fragment and fixed with one of the conventional nail plate device. However the procedure has disadvantage for causing shortening and weakening of the abductor mechanism. Moreover lag screw cut-out and progressive varus deformity after the Dimon-Hughston procedure sometimes occur.

Material and Methods

A prospective longitudinal study was carried out at a tertiary center at New Delhi and was conducted over a period of one and half years which included 60 patients, 30 patients in each group. Patients above 18 yrs with unstable Posteromedial large fragment fracture operated within 2 weeks of trauma were included in the study. Exclusion criteria being stable or undisplaced 2 part fracture, pathological fracture and polytrauma patients with fracture in the same extremity.

An informed written consent, a detailed clinical history, clinical examination and serial functional findings using a predesigned proforma were performed for all the participants. Ethical clearance was obtained. Patients with Intertrochanteric femur fracture usually present after a fall with swelling and pain over hip and thigh. To access the fracture both Antero-posterior and lateral view of hip and thigh are necessary. Other associated injuries of thigh and knee joint were checked for.

Standard pre-operative planning was done. Radiographs of the pelvis with both hips Antero-posterior view and traction internal rotation view was obtained to confirm the diagnosis.

The length of Richard's screw was measured pre-operatively on radiographs subtracting magnification. Neck shaft angle was measured to determine the angle for barrel plate. Non locking DHS plate with minimum of 6 cortices were fixed to the shaft distal to the fracture. In case of PFN, long PFN (size 300,320,360mm) and 135 degree angle nail was used. All cases were operated on a single standard fracture table under spinal anaesthesia using standard operative techniques with

the help of C arm machine.

Approach

Proximal Femoral Nail

The patient was placed in supine position on fracture table with adduction of the affected limb by 10-15 degree and closed reduction was done. The tip of the greater trochanter was located and 5 cms longitudinal incision taken proximal to the tip of greater trochanter. Fascia lata and gluteus medius was split and tip of the trochanter was exposed. In the AP view on C-arm, the entry point made on the tip or slightly medial to the tip of the greater trochanter. Guide wire inserted followed by reaming. PFN was inserted by slight twisting movement of the hand until the hole for 8 mm screw is at the level of inferior margin of the neck. In cases where satisfactory reduction was not possible by closed means, open reduction was done.

Dimon-Hughston osteotomy with DHS fixation

The Operation was performed on a traction table under spinal anaesthesia using lateral approach. If it was not fractured, the lateral wall of the greater trochanter underwent osteotomy and was elevated anteriorly; hence the end on view of the proximal fracture fragment could be used. Guide pin was inserted aiming at the center of the femoral head in AP and Lateral views. The hip screw was inserted. The medial metaphyseal spike of the proximal fragment was trimmed to jam it into the medullary cavity of the femoral shaft. The level of the transverse osteotomy was located at the shaft where three quarters of the cortical circumference was intact; the soft tissue attachment of the osteotomized trochanteric fragment was preserved and acted as a bone graft. The medial metaphyseal spike was fitted into the medullary cavity and the DHS plate was then fixed to the femur with cortical screws.

Post operatively intravenous antibiotics were continued for first 3 days and then changed to oral antibiotics for next 10 days. Drain was placed in all the patients to calculate the amount of blood loss. First dressing with drain removal was done on second post-operative day. All patients underwent similar rehabilitation protocol involving mobilization (crutch support with toe tip walking) from the second postoperative day depending upon the physical condition of the patient, static quadriceps, knee and ankle mobilisation exercises. Stitches were removed between 10-14th day. Functional outcome was assessed using Salvati and Wilson scoring system and radiological findings were compared at 3 months, 6 months.



Fig 1: Showing DHS plate fixation



Fig 2: DHS Immediate post-operative X-ray



Fig 3: Showing Proximal femoral nail insertion with Jig



Fig 4: PFN Immediate post operative x-ray

Statistical analysis

Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± SD and median. Normality of data was tested by Kolmogorov-Smirnov test. If the normality was rejected then non parametric test was used.

Statistical tests were applied as follows-

1. Quantitative variables were compared using Independent T test/Mann-Whitney Test (when the data sets were not normally distributed) between the two groups.
2. Qualitative variables were correlated using Chi-Square test/Fisher exact test.

A p value of <0.05 was considered statistically significant

The data was entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21.0.

Results

In this study we gave our primary concern in patient selection and all surgeries were performed by same surgeon and with same implants. The age of the patients included in our study ranges from 40-80 years with the mean age being 53.3±6.898 (mean ± SD in Dimon Hughston with DHS group and 55.87±8.016 in PFN group. 8(46.7%) being the maximum number of patients were in the age group of 51-60 years. The male and female ratio was 3:1 with 33 patients had sustained injury in their right and 27 in their left side. Injury to surgery interval was around 6-8 days with mean duration of injury to surgery interval was 7 days. The mean surgical time was 75 minutes in Dimon Hughston with DHS patients and 77 minutes in PFN patients. The mean time of weight bearing was 10.6 weeks in Dimon Hughston osteotomy with DHS patients and 11.5 weeks in PFN patients. The mean time of hospital stay was 3.67days. The mean time for radiological union was 14-18 weeks. The recovery of 49 patients out of 60 was uneventful in our study. Complications like breakage of screw, fixation failure, infection, lag screw cut out, limb shortening, non-union, screw backout, stiffness, varus angulation were noted.6.67% of DHS patients and 30% of PFN patients had little pain at rest and on activity and 93.33% of DHS patients & 70.00% of PFN patients had occasional slight pain at 6 months follow-up.10% of DHS patients and 26.67% of PFN patients had fair muscle power with flexion 60-70 and abduction of 10-20. 90% of DHS patients and 73.33% of PFN patients had good muscle power with flexion >90 and abduction >20 at 6 months follow-up.90% of DHS patients and 70% of PFN patients had very little function restriction at 6 months follow-up.

At 3 months of follow-up both Dimon-Hughston osteotomy patients and PFN patients had FAIR functional outcome.

Table 1: At 6 months of follow up

		Group		Total	P value
		Dimon-Hughston	PFN		
Total score at 6 months	Fair	0%	3.33%	1(1.67%)	0.012
	Good	20%	53.33%	22(36.67%)	
	Excellent	80%	43.33%	37(61.67%)	
Total		30 (100%)	30(100%)	60(100%)	

Grading of results
 Score >31=Excellent
 24-31=Good
 16-23=Fair
 <16=Poor

Total Score	Dimon Hughston	PFN	p value
At 3 months	23.13±1.634	22.00±2.349	0.012
At 6 months	31.40±1.589	29.60±2.799	0.002

Discussion

Incidence of unstable Intertrochanteric fracture femur has been reported to be from 10-34%.

The ideal implant for stabilization is still under debate. Many authors consider the sliding hip screw with a plate the best choice, extenuating its favorable results, the low rate of hardware failure and non-union. In our study we tried to evaluate functional outcome of PFN with Dimon Hughston osteotomy with DHS fixation in unstable intertrochanteric femur fracture. In our study mean age was 53.7years in DHS patient and 55.4years in PFN patients. In Laghari MA, the mean age was 63.9 years.38 patients had accidental fall and 22 patients following road traffic accident. Out of 60 patients, 33 sustained fracture on right and 27 on left side. In our study, according to Orthopaedic Trauma association classification of proximal femoral fractures, 37 had Type A2 fractures and 23 had Type A3 fractures. A2 fracture type was found to be more common in study group. The average interval of injury to surgery was found to be 7.7 days in Dimon Hughston and 7.0 days in PFN patients. Mean duration of surgery was 75 mins in Dimon Hughston and 77 minutes in PFN patients. Saudan *et al.* found that there was no significant difference between the operative times in the two groups in their series which was similar to our study. The average duration of full weight bearing was 10.6 weeks in Dimon Hughston patients and 11.5 weeks in PFN patients. Mean time for radiological union in our study was found to be 14-18 weeks with 15 weeks for Dimon Hughston patients and 16 weeks for PFN patients. Mean union time in study by Yiu HW was 10.6 weeks in geriatric patients.

Functional outcome was assessed by using Salvati and Wilson hip functional score. In our study we found that both group of patients had FAIR outcome at 3rd month. 20% of Dimon Hughston and 53.33% of PFN patients had GOOD functional outcome. 80% of Dimon Hughston and 43.33% of PFN patients had excellent functional outcome.

Mean Salvati and Wilson's scoring system at 3rd and 6th month was 23 and 31 for Dimon Hughston patients & 22 and 29 for PFN patients respectively, which is statistically significant showing better functional outcome in Dimon Hughston osteotomy patients. Saudan and colleagues found that the amount of persistent pain was similar in both groups in their series.

In our study population out of 60, one patient in each group had developed infection (3.33%). Tyllianakis *et al.* had similar finding in their study: long term results in 45 patients they had 4.44% infection. Infection rate in studies conducted by Desjardin's unstable femur fractures was 3.5% which is comparable to our study and in Butt *et al.* it was 4.5%. One patient in each group developed stiffness (3.33%). One PFN patient had backout of lag screw and breakage of screw in Dimon Hughston patients. Four studies provided data on lag screw cut out rate. Baumgaertner *et al.* showed that a small tip apex distance (TAD) less than 25 mm was associated with a lower probability for cutout. One patient had varus angulation and one fixation failure (1.67%) in PFN group. In the Dimon Hughston osteotomy patients there was a case of non-union due to jamming after which the patient responded to bone grafting. One patient in Dimon Hughston Osteotomy had shortening.

Conclusion

In our study of 60 patients with unstable intertrochanteric femur fractures were treated by Dimon Hughston osteotomy with dynamic hip screw fixation and proximal femoral nailing. Patients were followed up for six months and functional outcome were evaluated with Salvati and Wilson hip scoring system.

In our study we found that patients treated with Dimon Hughston osteotomy with DHS group for unstable intertrochanteric femur fractures show better results in comparing PFN in terms of early weight bearing, functional outcome, early radiological union but had got its own complications like infection, shortening, breakage of screw.

In our study patients treated with Dimon Hughston osteotomy with additional valgus alignment using a 135 degree DHS plate, this technique of osteotomy in the trochanteric area with valgus nailing and medial displacement was done to improve stability for such type of unstable intertrochanteric fractures.

Lateral position of the nail at the proximal portion can influence the formation of the varus angulation of the fracture site due to loss of buttress effect of the intramedullary nail and leads to the increased lever arm of the hip joint in proximal femoral nailing.

The analysis of the operation time shows no significant difference between the both groups.

In summary both Dimon Hughston osteotomy with DHS fixation and proximal femoral nailing are effective in the treatment of unstable intertrochanteric fractures.

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