ORIGINAL ARTICLE

Retrograde intramedullary nailing of femoral fractures with SIGN FIN Nail: an experience at Ghurki Trust Teaching Hospital

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Abstract:

Background: Retrograde intramedullary nailing of femur is now an established method of fixation of mid-shaft and distal femoral fractures. Other indications include ipsilateral femoral neck and shaft fractures, floating knee injuries, obesity and pregnancy.

Objective: To determine the outcome of retrograde femoral nailing with SIGN FIN Nail in patients with minimally comminuted mid and distal diaphyseal femoral fractures in terms of radiological union, SMFA score and complications.

Material and Methods: A descriptive case study incorporating 71 patients was conducted from April 2016 to June 2017 at Orthopedic Unit of Ghurki Trust Teaching Hospital, Lahore. Patients were admitted through emergency department. After following ATLS protocol, diagnosis was confirmed with orthogonal radiographs. After proper informed consent, Retrograde intramedullary nailing of the femoral fractures was done using SIGN FIN nail. Outcome was assessed in terms of radiological bony union, SMFA score and post-operative complications. Follow-up was done at 2 weeks, 4 weeks, 3 months and 6 months

Results: Mean age was 35.1±11.8 with 53(74.6%) males and 18(25.4%) females. 42(59.1%) fractures were mid-shaft and 29(40.9%) were distal diaphyseal. Mean follow-up time was 4.7 months (2-7 months). Radiological union was achieved in 92% of the patients at a mean follow-up of 4.5 months. Mean improvement in SMFA score was 56. 2(2.8%) patients lost to follow-up. 3(4.2%) patients developed superficial SSI which settled with antibiotics. 2(2.8%) patients later required exchange nailing and bone grafting for non-union.

Conclusion: Retrograde intramedullary nailing with SIGN FIN nail is easy to perform, time saving and results in excellent union rates. Good post-operative and long term musculo-skeletal function can be expected.

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Introduction:

The intertrochanteric fractures are extracapsular fractures running between greater and lesser trochanter. They are more common in elderly osteoporotic patients and are a cause of significant morbidity and mortality. They result from high energy trauma in younger adults.[1] The incidence of these fractures, particularly comminuted unstable type, is increasing. These fractures are four to five times more common than the femoral neck fractures.[2] The patients with intertrochanteric fractures are are usually ten to twelve years older than the patients with intracapsular femoral neck fractures.[3,4] These fractures are 2.3 times more common among females than males.[5] Less bone stock after menopause may be a factor.

These fractures constitute a significant work load on orthopedic and trauma departments, as these patients usually need longer hospital stays.[6] Satisfactory surgical treatment of these fractures requires a fine balance between biological and mechanical considerations of injury to increase chances of healing. Minimizing complications

and cost reduction is an important goal.[6]

Many classification systems have been proposed to delineate these fractures. Broadly, they can be grouped as stable and unstable fractures. Increasing comminution, reverse obliquity and sub-trochanteric extension are associated with increased instability.[7] Treatment of these unstable fracture has been particularly challenging for orthopedic surgeons due to high risk of mechanical failures of internal fixations.[8]

Over the decades, several implant designs have been developed for treating these fractures.[9] These implants can be divided into two groups-extramedullary implants such as DHS and cephalocondylic intramedullary implants such as the more recently developed PFN.[9] Dynamic hip screw was introduced in mid 20th century and became extremely popular.[10,11] Until recently, it was considered the gold standard treatment for trochanteric fractures.[10,11] Trochanteric entry cephalomedullary devices like PFN were developed almost two decades back.[12]

Bio-mechanical studies have shown that intramedullary devices (e.g. PFN) are more stable under dynamic loading. They have the advantage of improved shorter lever arm. These beneficial characteristics may facilitate early post-operative recovery and full weight bearing.[9] However, they are currently costlier and associated with higher risk of technical failure as compared to conventional extramedullary devices (i.e. DHS).[9]

A review of contemporary literature reveals that the optimal fixation device for inter-trochanteric fractures is still controversial and a subject of ongoing debate.[13,14] Huang X, et al found comparable effectiveness between PFN fixation and DHS fixation for inter-trochanteric fractures.[13] Shen L, et al in a meta-analysis of randomized controlled trials, reported that PFN was better than DHS in terms of a number of measured parameters but emphasized upon a need for further powered studies.[14] Comparing two implant designs, Bakhat U, et al found that the mean Harris Hip Score at 1 month for PFN group was 35.23±5.8 and that for the DHS group was 24.5±3.99; translating into better short term hip function and potential to early mobilization in PFN group.[15] Tao R, et al, however, found the mean Harris Hip Score to be 84.1±11.3 and 86.2 ± 5.64 for the two groups respectively.[16]

An intramedullary device like PFN, by more rapid improvement in hip function, can help reduce the cost and morbidity of hospital stay and time off-work. The aim of this study was to compare the outcome of fixation of intertrochanteric fractures in terms of post-operative hip function with the use of either implant design in our local population, as local data was found to be scarce (only one descriptive case series at Peshawar) and international data revealed considerable variability. Moreover, the demographics, nutritional status and vitamin-D levels of our population are different. With favorable results, use of Proximal Femoral Nail in unstable intertrochanteric fractures as a routine may be promoted, with its consequent advantages of early return of hip function and reduced over-all healthcare cost.

Material and Methods:

This randomized controlled trial was conducted in the Department of Orthopedics and Spine Surgery, Ghurki Trust Teaching Hospital Lahore from 15th July 2015 to 15th January 2016. The sample size was estimated as 60 cases (30 in each group) using 95% confidence interval, 80% power of test with an expected mean Harris Hip Score in DHS group as 24.5±3.99 and in PFN group as 35.23±5.815 and Non-probability consecutive sampling technique. Patient of either gender, age between 18-50, diagnosed with inter-trochanteric fracture type 31A2, 31A3 (AO/OTA classification) on radiographs, having no systemic or psychiatric illness (assessed clinically) and fit for anesthesia (ASA I/II) were included in the study while the patients unfit for surgery, having compound or pathological fracture, polytrauma patients or admitted for re-operation were excluded from the study.

After approval from hospital ethical committee, all the patients presenting to the Accident & Emergency Department, fulfilling the selection

Table-1: Harris Hip Score at 6 weeks

Implant	N	Mean	Standard Deviation	p-value
PFN	30	43.17	6.052	0.01
DHS	30	32.87	4.447	

Table-2: Stratification of Harris Hip Score in both Implant Groups with respect to Age

Age	Implant group	HHS		p-value
		n	Mean±SD	
51-60	PFN	5	44.6±2.3	0.01
	DHS	13	33.2±3.9	
61-70	PFN	10	42.6±5.8	0.01
	DHS	12	32.1±4.5	
71-80	PFN	12	42.1±5.8	0.01
	DHS	3	35±2.6	
81-90	PFN	3	45±6.5	0.01
	DHS	2	32±11.3	

Table-3: Stratification of Harris Hip Score in both Implant Groups with respect to Gender

Gender	Implant Group	HHS		p-value
		n	Mean±SD	
Male	PFN	20	42.3±5.8	0.01
	DHS	17	33.7±4.7	
Female	PFN	10	44.3±5.2	0.01
	DHS	13	37.2±7.7	

criteria, were included in the study. The patients were counseled regarding the procedure and the objective of the study. Informed written consent was taken. The demographic information was recorded (name, age, sex etc.). All the information was collected through a specially designed proforma. The patients were randomized to either group-A or B. They were not be aware of the randomization arm and were selected via lottery method. In group-A, internal fixation was done with PFN. In group-B, internal fixation was done with DHS.

All procedures were performed the same day by final year post-graduate residents under consultant supervision. All the patients were be given one dose of prophylactic antibiotic (a 1st generation cephalosporin) pre-operatively and two doses post-operatively. Strict sterilization and use of aseptic techniques was ensured. Under fluoroscopic guidance, internal fixation was done with either PFN or DHS according to the randomization arm of the patient. After discharge patients were followed-up initially on 10th post-operative day and fortnightly thereafter. Harris Hip Score was calculated upon follow-up at 6 weeks with the help of a printed questionnaire (annexure II). Patient's proforma (annexure I) was then filled accordingly. SPSS version 17 was used for data analysis. Quantitative variables like age, BMI and Harris Hip Score (outcome variable) are presented in the form of mean+S.D. Qualitative variables like gender and malnutrition are presented in the form of frequency and percentage. in mean Harris Hip Score of either group. P value ≤ 0.05 was considered as significant.

Results:

This study included a total of 60 patients who presented to the Department of Orthopedics and Spine Surgery, Ghurki Trust Teaching Hospital Lahore through accident and emergency with the inter-trochanteric fractures. There were 37 males and 23 females with male to female ratio of 1.6:1. The mean±SD of the age distribution was 66±9.4 years. There were 40 AO type 31A2 and 20 AO type 31A3 unstable inter-trochanteric fractures. PFN was used in 20 males and 10 females while DHS was used in 17 males and 13 females. Mean Harris Hip Score at 6 weeks was 32.8±4.5 for the DHS group and 43.8±6.1 for the PFN group (table-1) which was found to be statistically significant using independent samples t-test. P value ≤ 0.05 was considered as significant. stratified data according to age and gender to address effect modifiers are summarized in table-2 and table-3.

Discussion:

Unstable inter-trochanteric fractures pose a difficult challenge to the orthopedic surgeons. They commonly affect elderly osteoporotic patients and carry a high risk of morbidity and mortality. With the rapid increase in the elderly population, the morbidity of inter-trochanteric femoral fractures is also displaying a rising trend. And they account for approximately half the hip fractures in elderly patients.[16]

The elderly frail patients lack the co-ordination and strength required to counter the excessive

stresses on these fracture while ambulating with crutches and support. Immaculate balance of fracture reduction and implant strength is important.[17] Associated adverse medical conditions and prolonged immobilization are responsible for high rates of morbidity and mortality in these patients.[18]

Functional outcome of such fractures depends upon several factors including patient's general health and activity level before fracture. Primary goal in the elderly patients is to return the patient to his pre-fracture activity as soon as possible. This aim can be achieved by having stable reduction of the fracture, adequate internal fixation, minimal anesthesia time and blood loss and early mobilization.

To achieve early ambulation of patients with an inter-trochanteric fracture, two conditions must be met: the implant used for fixation must be strong enough to withstand loading exerted upon it during fracture healing and the fracture itself must be rendered stable in suitably reduced position.[19]

In the treatment of these fractures, preservation of ambulatory function is of paramount importance. Severe loss in ambulatory function would increase the risk of having socio-economic problems.[20] The level of ambulation achieved in the post-op period is a function of the pre-operative mobility status and medical condition, associated skeletal injuries, the quality of fracture stabilization, peri operative complications and early ambulation.

Over the decades, a great amount of endeavor has gone into perfecting the design and biomechanics of implants used for fixation of these fractures. These implants can be divided into two groups- extramedullary implants such as Dynamic Hip Screw (DHS) and cephalo-medullary implants such as the more recently developed Proximal Femoral Nail (PFN). Bio-mechanical studies have shown that intramedullary devices (e.g. PFN) are more stable under loading, have the advantage of improved shorter lever arm and may provide for early post-operative recovery and full weight bearing. However, they are currently costlier and associated with higher risk of technical failure as compared to conventional extramedullary devices (i.e. DHS).

Keeping in view these bio-mechanical attributes of PFN, this study was designed to see if these advantages actually translated into early mobilization and quicker improvement in hip function. This was measured in terms of Harris Hip Score at 6 weeks. Harris Hip Score (range 0-100) is a reliable measure of post-operative hip function in hip surgeries and covers the domains like pain, function, absence of deformity, and range of motion.

A review of contemporary literature reveals that the optimal fixation device for inter-trochanteric fractures is still controversial and a subject of ongoing debate. Huang X, et al found comparable effectiveness between PFN fixation and DHS fixation for inter-trochanteric fractures.[13] Shen L, et al in a meta-analysis of randomized controlled trials, reported that PFN was better than DHS in terms of a number of measured parameters but emphasized upon a need for further powered studies.[14]

Mean age of the patients in this study was 66±9.4 and male to female ratio was 1.6:1. In this randomized controlled trial, the mean Harris Hip Score for PFN group was found to be 43.2±6.1 and that for the DHS group 32.9±4.4 at 6 weeks. The difference was found to be statistically significant using independent samples t-test. It essentially meant that, after 6 weeks of the operative fixation, patients of PFN group had relatively better hip function, less disability and better activity level.

Comparing two implant designs, Bakhat U, et al found that the mean Harris Hip Score at 1 month for PFN group was 35.23±5.8 and that for the DHS group was 24.5±3.99; translating into better short term hip function and potential to early mobilization in PFN group.[15] Tao R, et al, in another study, however, found the mean Harris Hip Score to be 84.1±11.3 and 86.2±5.64 for the two groups respectively.[16] Although my

study confirmed the findings of reports showing chronologically improved hip function in short term with PFN, a detailed recourse of the literature shows considerable variability in outcome and underscores a need for further powered and multicenter studies on the subject.

The limitations of this study include relatively small sample size and inclusion of only a single variable in the study. Moreover, this study projects only the short term outcome of two different fixation devices.

Conclusion:
This study concludes that Proximal Femoral Nail, because of its improved bio-mechanical design, can bring about a quicker improvement in the hip function as compared to Dynamic Hip Screw. This may allow early mobilization and return to work in patients with unstable intertrochanteric fractures. Risks associated with prolonged immobilization may be decreased, significantly reducing the overall morbidity, time off-work and, indirectly, the financial burden of these very common fractures on our meager healthcare resources.

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Role and contribution of authors:
Dr Umair Nadeem, collected the data, references did the initial writeup

Dr Muhammad Farrukh Bashir, helped in collecting the data and introduction writing

Dr Saeed Ahmad, collected the references and helped in introduction writing

Dr Ashfaq Ahmad, collected the references and helped in discussion writing

Dr Rizwan Akram, helped in collecting the data and discussion writing

Dr Shahzad Javed, helped in collecting the data and references

Dr Amer Aziz, critically review the article and made the final changes

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