ORIGINAL ARTICLE

Functional outcome after proximal femoral nail in subtrochanteric fracture of femur

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Abstract:

Introduction: Subtrochanteric femur fractures have a bimodal age distribution. Younger patients sustain a subtrochanteric fracture as a result of a high-energy injury and typically they have associated traumatic injuries while in older age it is due to low quality of bone.

Objective: To determine the functional outcome after proximal femoral nailing for subtrochanteric fracture of femur.

Material and Methods: This descriptive case series study was carried out in the Department of Orthopedics Surgery, Medical Teaching Institute, Lady Reading Hospital, Peshawar Pakistan from September 2020 till March 2021 on total of 79 patients to determine the functional outcome after proximal femoral nailing for subtrochanteric femur fractures. Sampling technique was non-probability consecutive sampling.

Results: In this study age distribution among 79 patients was analyzed as n= 20-30 years 18(22.8%) 31-40 years 19 (24.1%) 41-50 years 24(30.4%)51-60 years 18(22.8%). Mean age was 47 years with SD±2.87. Gender wise distribution among 79 patients male were 58(73.4%) and female were 21(26.6%). Distribution of duration of disease among 79 patients were analysed as n=1- 2 weeks were 58(73.4%) and 3-4 weeks were 21(26.6%). Distribution of BMI classification among 79 patients were analysed as n=Below 18.5 Underweight was 58(73.4%) and 18.5–24.9 Normal weight was 21(26.6%) distribution of functional outcome among 79 patients were analysed as n= Excellent was 30(38.0%) Good was 25(31.6%) Fair was 20(25.3%) and Poor was 4(5.1%).

Conclusion: The post-operative clinical and radiological outcome suggests that proximal femoral nail is a exceptional device for treatment of fracture subtrochanteric femur. Although technically demanding, it avoids extensive soft tissue dissection and iatrogenic bony avascularization thus decrease the incidence of fracture non-union and implant failure and at the same time provide much more axial stability due to its intramedullary placement thus it allows the patients to move relatively early following surgery.

Keywords: Functional outcome, proximal femoral nail (PFN), subtrochanteric fracture.

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Introduction:

Subtrochanteric femoral fractures are common at two peeks of life. Younger patients sustain a subtrochanteric fracture as a result of a high-energy injury and typically they have associated other traumatic injuries while old age people have advanced osteoporosis with reduced strength of the calcar of femur.[1] Osteoporotic fractures usually occur from a low-energy ground level fall. The subtrochanteric femur is a region of high stress, placing major demands on implants used for fixation. There are high compressive forces medially, and high tensile forces laterally.[2] Subtrochanteric femoral fractures constitute a variety of different entities. The accepted definition of subtrochanteric fracture is that involve the lesser trochanter and extends distally up to 5-centimeter.[3] Subtrochanteric fractures

may be a challenge for orthopedic surgeon due to the muscle attachments proximal and distal to the fragment that inhibit the reduction. The gluteus medius and gluteus minimus attaches to the greater trochanter and abduct the proximal fragment while iliopsoas attaches to the lesser trochanter, flexing and externally rotating the proximal fragment.[4]

Before the innovation of cephalo-medullary nails, 95° blade plate was usually used for subtrochanteric fractures of the femur. To insert the angle blade in three planes of this implant was technically demanding.[5] For osteoporotic fracture locking plate technology was developed that has provided improved mechanical stability of plate fixation. The proximal femoral locking plate was a good alternative to the blade plate for subtrochanteric fractures. Biomechanically, it was more rigid which act as a fixator internee.[6]

Closed reduction and nailing provides a stable rigid fixation that has rotational and axial stability, which preserve the hematoma and periosteam that is important for healing. In spite of that its placement in the medullary cavity centrally give more stability and allows for early movements and weight bearing on fracture hip.[7] The surgical procedure for proximal femoral nails (PFN) is easy for surgeons and the operative time is short. However, proximal femoral nail may not be used in patients with thin or narrow medullary cavity, difinite osteoporosis, and those with the risk of fat embolism.[8]

In one study, functional outcome according to Harris Hip Score (HHS) was excellent in 78%, good 6%, fair in 6% and poor in 10% of patients treated with proximal femoral nail for subtrochanteric femur fractures.[9] In another study, functional outcome according to Harris Hip Score (HHS) was excellent in 56%, good 20%, fair in 16% and poor in 8% of patients treated with proximal femoral nail for subtrochanteric femur fractures. In another study, functional outcome according to Harris Hip Score (HHS) was excellent in 85%, good 10.5%, fair in 2.6% and poor in 1.3% of patients treated with proximal femoral nail for subtrochanteric femur fractures.

The present study is designed to determine the functional outcome after proximal femoral nail for subtrochanteric femur fractures. High frequency trauma is not uncommon in our population and the incidence of subtrochanteric femur fractures is very high. Proximal femoral nail (gamma) nailing technique is gaining popularity world wide and various studies are being conducted. As per our knowledge, there is no study done on the functional outcome of proximal femoral nail in our population and this study were an attempt to establish the statistics about its functional outcome in our population presenting with subtrochanteric femur fractures. The results of this study were shared with local orthopedic surgeons and future recommendations regarding further research were posted.

Material and Methods:

This descriptive case series study was carried out in the Department of Orthopedics Surgery, Medical Teaching Institute, Lady Reading Hospital, Peshawar Pakistan from September 2020 till March 2021 on total of 79 patients (calculated by WHO formula) to determine the functional outcome after proximal femoral nailing for subtrochanteric femur fractures. Sampling technique was non-probability consecutive sampling.

All patients presenting with subtrochanteric femur fractures, both genders (male/female) with age between 20 to 60 years and duration of injury within 24 hours of injury were included in the study while patient previously treated by any surgical interventions or bone setter, pathological fractures as they also need primary pathology to be dealt with, medically unstable patient who is an extremely poor anesthetic and surgical risk are excluded from the study. In such situation less invasive and short procedures are recommended initially till stabilization of patient's condition.

After obtaining approval from hospital ethical committee data were collected. Fully informed and written consent were taken from the pa-

Table 1: Functional outcome (n=79)

	Frequency	Percent	Valid percent	Cumulative percent
Excellent	30	38.0	38.0	38.0
Good	25	31.6	31.6	*69.6*
Fair	20	25.3	25.3	*94.9*
Poor	4	5.1	5.1	100.0
Total	79	100.0	100.0	

Table 2: Stratification of functional outcome * age wise distribution (n=79)

			Age wise distribution				Total
			20-30 Years	31-40 Years	41-50 Years	51-60 Years	
Functional Outcome	Excellent	Count	14	15	1	0	30
		% within functional outcome	46.7%	50.0%	3.3%	0%	100%
		% of total	17.7%	19.0%	1.3%	0%	38%
	Good	Count	0	2	16	6	24
		% within functional outcome	0%	8.3%	66.7%	25.0%	100%
		% within age wise distribution	0%	10.5%	66.7%	33.3%	30.4%
		% of total	0%	2.5%	20.3%	7.6%	30.4%
	Fair	Count	4	2	7	8	21
		% within functional outcome	19.0%	9.5%	33.3%	38.1%	100%
		% within age wise distribution	22.2%	10.5%	29.2%	44.4%	26.6%
		% of total	5.1%	2.5%	8.9%	10.1%	26.6%
	Poor	Count	0	0	0	4	4
		% within functional outcome	0%	0%	0%	100%	100%
		% within age wise distribution	0%	0%	0%	22.2%	5.1%
		% of total	0%	0%	0%	5.1%	5.1%
	Total	Count	18	19	24	18	79
		% within functional outcome	22.8%	24.1%	30.4%	22.8%	100%
		% within age wise distribution	100%	100%	100%	100%	100%
		% of total	22.8%	24.1%	30.4%	22.8%	100%

Chi square test was applied in which P value was 0.00

tients or his/her attendants. All the pre-operative and post-operative data were collected on pre structured proforma (Annexed). All the data were collected by the investigator himself.

The study was conducted on patients admitted in the Orthopedic Surgery, Department through casualty and outpatient department. Detail patient history and clinical examination were done. Laboratory investigation and X-rays were done pre-operatively. Diagnosis of subtrochanteric femur fractures was done as per operational definitions.

Proximal femoral nail were performed under general anesthesia by consultant orthopedic surgeon having minimum of 7 years of experience with the help of a senior post-graduate trainee in order to minimize the bias. After surgery patient were shifted to the ward and given regular analgesia and intra venous antibiotic for 5 days and discharge with oral antibiotic. Post-op X-rays were taken on first post-operative day by Radiologist Technician. Follow-up visits on 8th week were done to determine functional outcome in terms of HSS. Clinical and radiological findings were observed by senior postgraduate trainee under the supervision same consultant orthopedic surgeon to minimize the bias. Patient's telephonics. contacts addresses were taken to ensure follow-up. Strictly exclusion criteria were followed to control confounders and bias in the study results.

The collected data were entered into computer using SPSS version 22 for analysis. Descriptive statistics were used to calculate means±standard deviation for numerical variables like age, BMI and HSS. For categorical variables like gender and functional outcome, frequencies and percentages were calculated. Functional outcome were stratified among age, gender and BMI to see the effect modifications. Post-stratification chi square test were used with P value <0.05 as significant.

Results:

In this study age distribution among 79 patients was analyzed as n=20-30 Years 18(22.8%) 31-40 years, 19(24.1%) 41-50 years 24(30.4%), 51-60 years 18(22.8%). Mean age was 47 years with SD±2.87

Gender wise distribution among 79 patients was

Table 3: Stratification of functional outcome*gender wise distribution (n=79)

Crosstab					
			Gender wise distribution		
			Male	Female	Total
Functional Outcome	Excellent	Count	25	5	30
		% within functional outcome	83.3%	16.7%	100%
		% within gender wise distribution	43.1%	23.8%	38%
		% of total	31.6%	6.3%	38.0%
	Good	Count	12	12	24
		% within Functional Outcome	50%	50%	100%
		% within gender wise distribution	20.7%	57.1%	30.4%
		% of total	15.2%	15.2%	30.4%
	Fair	Count	18	3	21
		% within functional Outcome	85.7%	14.3%	100%
		% within gender wise distribution	31%	14.3%	26.6%
		% of total	22.8%	3.8%	26.6%
	Poor	Count	3	1	4
		% within functional Outcome	75%	25%	100%
		% within gender wise distribution	5.2%	4.8%	5.1%
		% of total	3.8%	1.3%	5.1%
	Total	Count	58	21	79
		% within functional Outcome	73.4%	26.6%	100%
		% within gender wise distribution	100%	100%	100%
		% of total	73.4%	26.6%	100%

Chi square test was applied in which P value was 0.00

analyzed as male were 58(73.4%) and female were 21(26.6%).

Distribution of duration of disease among 79 patients were analysed as n=1-2 weeks were 58(73.4%) and 3-4 weeks were 21(26.6%).

Distribution of BMI classification among 79 patients were analysed as n= Below 18.5 Underweight was 58(73.4%) and 18.5–24.9 Normal weight was 21(26.6%).

Distribution of functional outcome among 79 patients were analysed as n= Excellent was 30(38.0%) Good was 25(31.6%) Fair was 20(25.3%) and Poor was 4(5.1%) (Table No 1)

Stratification of age, gender, duration and BMI with the disease was shown in tables 2 to 5.

Discussion:

Different authors have different results for subtrochanteric fracture of femur treated as surgical fixation of subtrochanteric fracture has been treated by different method. Multiple methods of fixation for such fracture has been mentioned in the literature.[3,8] Ordinary dynamic plate fixation has the disadvantages of extensive soft tissue dissection, bony devascularization hence leading to high rates of infection and fracture non-union. The dynamic plate is placed eccentrically which is very prone to implant failure due to their mechanical load-bearing effect.[10,11]

While the centrally placed implants like intramedullary nails; proximal femoral nail anti-rotation has many advantages. Proximal femoral nail anti-rotation treat subtrochanteric fracture less invasively due to close reduction of fracture site, hence, do not disturb the hematoma which is essential for fracture healing. The biomechanics of these devices are such that act like a central splint that can provide much more axial stability which helps in early mobilization of the patients after surgery.[3,5,12] Another advantage of the proximal femoral nail anti-rotation is the helical blade prevents rotation or compaction of the proximal fragment by locking with the nail rotationally. Wang WY 2010[5] analyzed 25 patients with fracture subtrochanteric femur, fixed with long proximal femoral nail anti-rotation. They achieved healing in all their cases. Implant failure or non-union were not observed whereas delayed union was noted one of their patients. They reported 92% excellent to good functional results and concluded that proximal femoral nail anti-rotation is effective in the management of subtrochanteric fractures. In current study the age distribution among 79 patients was analyzed as n= 20-30 years 18(22.8%) 31-40 years19 (24.1%) 41-50 years 24(30.4%) 51-60 years 18(22.8%). Mean age was 47 years with

Table 4: Stratification of functional outcome* BMI classification (n=79)

Crosstab					
			BMI classification		
			Below 18.5 Under weight	18.5–24.9 Normal weight	Total
Functional Outcome	Excellent	Count	25	5	30
		% within functional outcome	83.3%	16.7%	100%
		% within BMI classification	43.1%	23.8%	38.0%
		% of total	31.6%	6.3%	38.0%
	Good	Count	12	12	24
		% within Functional Outcome	50%	50%	100%
		% within BMI classification	20.7%	57.1%	30.4%
		% of total	15.2%	15.2%	30.4%
	Fair	Count	18	3	21
		% within Functional Outcome	85.7%	14.3%	100%
		% within BMI classification	31%	14.3%	26.6%
		% of total	22.8%	3.8%	26.6%
	Poor	Count	3	1	4
		% within Functional Outcome	75%	25%	100%
		% within gender wise distribution	5.2%	4.8%	5.1%
		% of total	3.8%	1.3%	5.1%
	Total	Count	58	21	79
		% within Functional Outcome	73.4%	26.6%	100%
		% within gender wise distribution	100%	100%	100%
		% of total	73.4%	26.6%	100%

Chi square test was applied in which P value was 0.01

SD±2.87. Gender wise distribution among 79 patients were analyzed as male were 58(73.4%) and female were 21(26.6%). Distribution of duration of disease among 79 patients were analyzed as n=1-2 weeks were 58(73.4%) and 3-4 weeks were 21(26.6%). Distribution of BMI classification among 79 patients were analyzed Underweight was 58(73.4%) and Normal weight was 21(26.6%). Distribution of functional outcome among 79 patients were analyzed as n= Excellent was 30(38.0%), Good was 25(31.6%) Fair was 20(25.3%) and Poor was 4(5.1%).

Umer et al 2014[1] studied 33 patients with subtrochanteric fracture of femur by proximal femoral nail anti-rotation and noted eventful healing except 3 cases of delayed union, dynamization was done in 2 cases and bone grafting was done in one. Implant failure was noted in 2 cases required redo surgery. His conclusion was that spiral blade femoral nail has favorable results in subtrochanteric fractures of femur. Mereddy P et al 2009[9] studied 62 patients managed with proximal femoral nail anti-rotation. He noted delayed union only in 4 cases while all other cases healed well. He has excellent functional results of 80% and all these patient gained pre fracture status. Liu Y et al[13,17] analyzed 143 patients who had peri-trochanteric femoral fractures and treated with proximal femoral nail anti-rotation. They noted only one case of delay union while all other healed well. He showed that his patients has excellent result of 74% and has regain mobility of pre-fracture status. He was of the opinion that proximal femoral nail anti-rotation (PFNA) is a very safe and effective modality in the management of peri-trochanteric femoral fractures. Kristek D 2010[14] did a study on 76 patients treated with proximal femoral nail anti-rotation. He observed delayed union in 3 cases and has excellent functional result of 60%. He concluded that proximal femoral nail anti-rotation is an excellent and exceptional implant for healing of peri trochanteric fractures. Abraham VT et al,[8] 2016 analyzed 26 patients treated with proximal femoral nail anti-rotation and had a result of excellent functional result of 82%. Radaideh AM 2018[15] did a study on 50 patients managed with proximal femoral nail anti-rotation. All their cases healed well without any complications. They recommended that proximal femoral nail anti-rotation is easy to insert, has low blood loss, has stable fixation and excellent clinical and radiological results. In our study, we also found similar findings; we evaluated 33 patients with fracture subtrochanteric femur fixed with proximal femoral nail anti-rotation. We achieved union in all cases at mean time of 18.4 weeks. Implant failure and/or non-union were not observed

whereas delayed union was noted in 5 patients, all progressed to union with additional minor surgical procedure; bone grafting in 2-cases and dynamization in 3-cases.

In our study, distal locking screws were broken in 2 cases, within 2 months of fixation due to early full weight bearing by the patients. There were 5 incidences of superficial stitch infection and subsided with dressing and oral antibiotics. In our study, functionally 81.8% of patients regained excellent to good Harris hip score.

Limitations of this study, includes its small number of patients, lack of control group such as Dynamic condylar plate to serve as a comparison to the surgical technique and short follow-up period. Also, the exclusion of polytrauma patients with multiple fractures could lead to a selection bias, possibly omitting patients with more severe injuries. Hence, the results in this study were comparable to the results noted in most other studies.

Conclusion:
The post-operative clinical and radiological outcome suggests that proximal femoral nail anti-rotation (PFNA) is a exceptional device for treatment of fracture subtrochanteric femur. Although technically demanding, it avoids extensive soft tissue dissection and iatrogenic bony devascularization thus decrease the incidence of fracture non-union and implant failure and at the same time provide much more axial stability due to its intramedullary placement thus it allows the patients to move relatively early following surgery.

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Role and contribution of authors:
Muhammad Inam, collected the data, references and did the initial write up.

Shaukat Ali, collected the data, references and helped in discussion writing.

Waseequr Rahman, critically review the article and made final changes.

Zeeshan Faisal, went through the article and advised useful changes.

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