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Early Functional Outcome of Proximal Femoral Nail Antirotation in Treatment of Unstable Intertrochanteric Fractures

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Abstract

Background: *Unstable Intertrochanteric fractures are one of the commonest hip fractures mainly in elderly patients due to low energy trauma. The goals of care are to restore near pre-trauma function with the lowest possible rate of surgical and medical complications. Achieving stable reduction and fixation of the fracture, permitting immediate mobilization, is key to these goals. The last years have seen the introduction and increasing acceptance and use of intra-medullary devices in preference to the extra-medullary devices for the treatment of unstable intertrochanteric fractures.*

Objective: *To evaluate the early Functional outcome of proximal femoral nail anti-rotation in the treatment of unstable intertrochanteric fractures after three months post-operatively by using mHHS.*

Methods: *Descriptive cross-sectional Multicentre hospital-based study of 40 patients with unstable intertrochanteric fracture, A2.2 through A3.3.*

Results: *Forty patients with an unstable intertrochanteric femur fracture, operated with PFNA, were enrolled in the study. There were 22 males and 18 females included in this study. Right hip 24, left hip 16. The age was classified according to the WHO classification young adults (less than 39 years) 5, middle-aged adults (40 – 59 years) 3 and old adults (more than 59 years) 32. We used the modified Harris Hip Score to assess postoperative pain, function, and functional activities. 31 patients had no pain, 24 had slight limping, 13 used a cane for a long walk, 18 patients walked for 2-3 blocks, and 21 climbed the stairs normally with banisters, 29 patients put on socks/shoes, 38 patients sat at any chair for one hour, 25 patients abled to use public transportation. Modified Harris Hip Score (mHHS) was categorized into four groups less than 70 (poor), 70-79 (fair), 80-89 (good), more than 90 (excellent). Most of the patients are scored fair (12 patients) and good (17 patients). The association between mHHS and demographic data by crosstabs using Pearson Chi-Square. There is a statistically significant difference between the mHHS and the age group and gender with a p-value of 0.000 and .031 respectively, meaning that the functional outcome was excellent in young patient and the more patient's age the less functional outcome. On the hand all excellent results are founded in male patients. And operated hip didn't affect the final mHHS of the patient a p-value of .252.*

Conclusion: *We believed our study had shown that the PFNA works well in the treatment of unstable intertrochanteric fractures, post-operative pain was ignored in most of our patients, 60% had slight limping not compromised their daily activity, most of them used a cane for walking 2-3 blocks, 52.5% climbed the stairs with banister, 72.5% put on socks/shoes with ease, 95.0% sitting in any chair for a long time and 62.5% entered public transportation. The overall functional outcome of our patients falls between good and fair.*

Introduction

Unstable Intertrochanteric fractures are one of the commonest hip fractures mainly in elderly patients due to low energy trauma.

The goals of care are to restore near pre-trauma function with the lowest possible rate of surgical and medical complications. Achieving stable reduction and fixation of the fracture, permitting immediate mobilization, is key to these goals.(1)

The intertrochanteric region has many thickenings of trabecular bone in compressive and tensile lines. The most structurally significant of these are the primary compressive trabeculae along the posteromedial femoral neck and shaft. Instability increases with the degree of comminution of the posteromedial cortex. Increased comminution implies less support for axial loading through cortical contact. the quality of reduction, irrespective of the pattern of the fracture, is one amongst the most important modifiable factors within the management of unstable intertrochanteric fractures. Implants accustomed to fix such fractures must be capable of bearing more loads, to avoid loss of reduction through collapse. A valgus reduction is a technique of increasing inter-fragmentary compression and of reducing bone-implant stresses, in addition as minimizing collapse and leg length discrepancy. (1)

The last years have seen the introduction and increasing acceptance and use of intra-medullary devices in preference to the extra-medullary devices for the treatment of unstable intertrochanteric fractures. (1)

Decision-making in the management of intertrochanteric fractures requires a thorough understanding of the stability of the fracture and the available implants.

Many options for fixation of unstable intertrochanteric fractures including extra medullary devices such as dynamic hip screw, proximal femoral locking plate and intramedullary devices such as proximal femoral nail, medial sustainable nail and proximal femoral nail antirotation.

In this study we used AO/OTA classification and our patients were presented with unstable intertrochanteric fracture (A2.2 through A3.3)

In this study, we review the early functional outcome of proximal femoral nail anti-rotation in the treatment of unstable intertrochanteric fractures by using a modified Harris Hip Score which was derived from the original version developed by William Harris. The original version of the score was first published in 1969.

Problem statement

The best surgical options between extra medullary and intramedullary devices for the treatment of unstable intertrochanteric fractures remained controversial.

Most cases of unstable intertrochanteric fractures are treated by intramedullary devices such as PFN and PFNA.

There is a little information about the superiority and choice between intramedullary devices used in the treatment of unstable intertrochanteric fractures.

Justification

The current study aims to enrich the local data regarding the functional outcome of proximal femoral nail anti-rotation in the treatment of unstable intertrochanteric fractures because there is no published work in Sudan regarding this procedure. And to help surgeons to make clear decision and which suitable device when treating unstable intertrochanteric fractures.

Cephalomedullary nail (4)

Early intramedullary nails used for fractures of the hip were short and associated with a risk of fracture at the tip of the nail, with an incidence of 8% to 11% historically. Long nails can prevent this complication but risk anterior cortical impingement or intra-operative iatrogenic fracture with incidences of 1.5% and < 1% recorded. For this reason, the surgeon must be conscious of the design of the nail including its radius of curvature and the anterior bow of the femur. Distal locking may be protective against periprosthetic fracture in both short and long nails.

Some intramedullary implants use a helical blade for fixation of the femoral head instead of a cancellous screw. Biomechanical studies in artificial, cadaveric, and living bone have shown that a blade resists rotational and translational displacement better. The use of blades may be associated with the phenomenon of 'cut-through' with medial perforation of the articular surface of the femoral head without loss of reduction of the fracture. The tip of the blade should be a minimum of 10 mm from the joint surface.

There are variants with both one (uniaxial) and two (biaxial) screws in the femoral head. Greater load to failure has been reported with biaxial screws in a biomechanical study.

Intertrochanteric fractures:

Fractures of the hip are common injuries. Approximately 50% of hip fractures occur in the intertrochanteric region, the prevalence of which increases exponentially with age. It is also associated with a high rate of morbidity and mortality. Beyond preventing avoidable deaths, the goal of the treatment is to restore patients to their pre-injury level of mobility. (5)

Intertrochanteric fractures are defined as extra capsular fractures of the proximal femur that occur between the greater and lesser trochanter. The intertrochanteric aspect of the femur is located between the greater and lesser trochanters and is composed of dense trabecular bone. The greater trochanter serves as an insertion site for the gluteus medius, gluteus minimus, obturator internus, piriformis, and site of origin for the vastus lateralis. The lesser trochanter serves as an insertion site for the iliacus and psoas major commonly referred to as the iliopsoas. The calcar femorale is the vertical wall of dense bone that extends from the posteromedial aspect of the femur shaft to the posterior portion of the femoral neck. This structure is important because it determines whether or not a fracture is stable. The vast metaphyseal region has a more abundant blood supply, contributing to a higher union rate and less osteonecrosis compared to femoral neck fractures. (6)

These fractures occur both in the elderly and the young, but they are more common in the elderly population with osteoporosis due to a low energy mechanism. In the younger population, these fractures typically result from a high-energy mechanism. (7)

Intertrochanteric fractures can be stable or unstable depending on whether it is a two or three-part fracture. Those fractures deemed unstable are often difficult to reduce and usually require an implant for stabilization. (8)

Plain radiographs are the initial films chosen to evaluate for these fractures. The recommended views include the anteroposterior (AP) pelvis, AP, and cross-table lateral of the affected hip and full-length radiographs of the affected femur. Although the diagnosis can be made without pelvic films, pelvic radiographs are useful to assist in preoperative planning for restoration of the proper neck-shaft angle. Full-length radiographs of the femur are useful to assess for deformities of the femur shaft which could affect the placement of an intramedullary nail and evaluation of prior implants in the distal femur. CT and MRI are typically not indicated but can be used if radiographs are negative, although the physical exam is consistent with a fracture. Additionally, a physician-assisted AP traction view of the injured hip can be helpful in further characterizing fracture morphology and the feasibility of closed reduction or the need for open reduction techniques. (9)(10)

It is universally accepted that the treatment of trochanteric fractures necessitates stable internal fixation allowing early mobilisation as soon as possible. Stable fixation till fracture union is the keystone to a successful outcome. (11)

The modified Harris Hip Score (mHHS) has adequate construct validity, internal validity, and responsiveness to evaluate the functional outcome of intramedullary nail fixation in pertrochanteric hip fractures in the Indian population. (12)

Classification systems :(13)

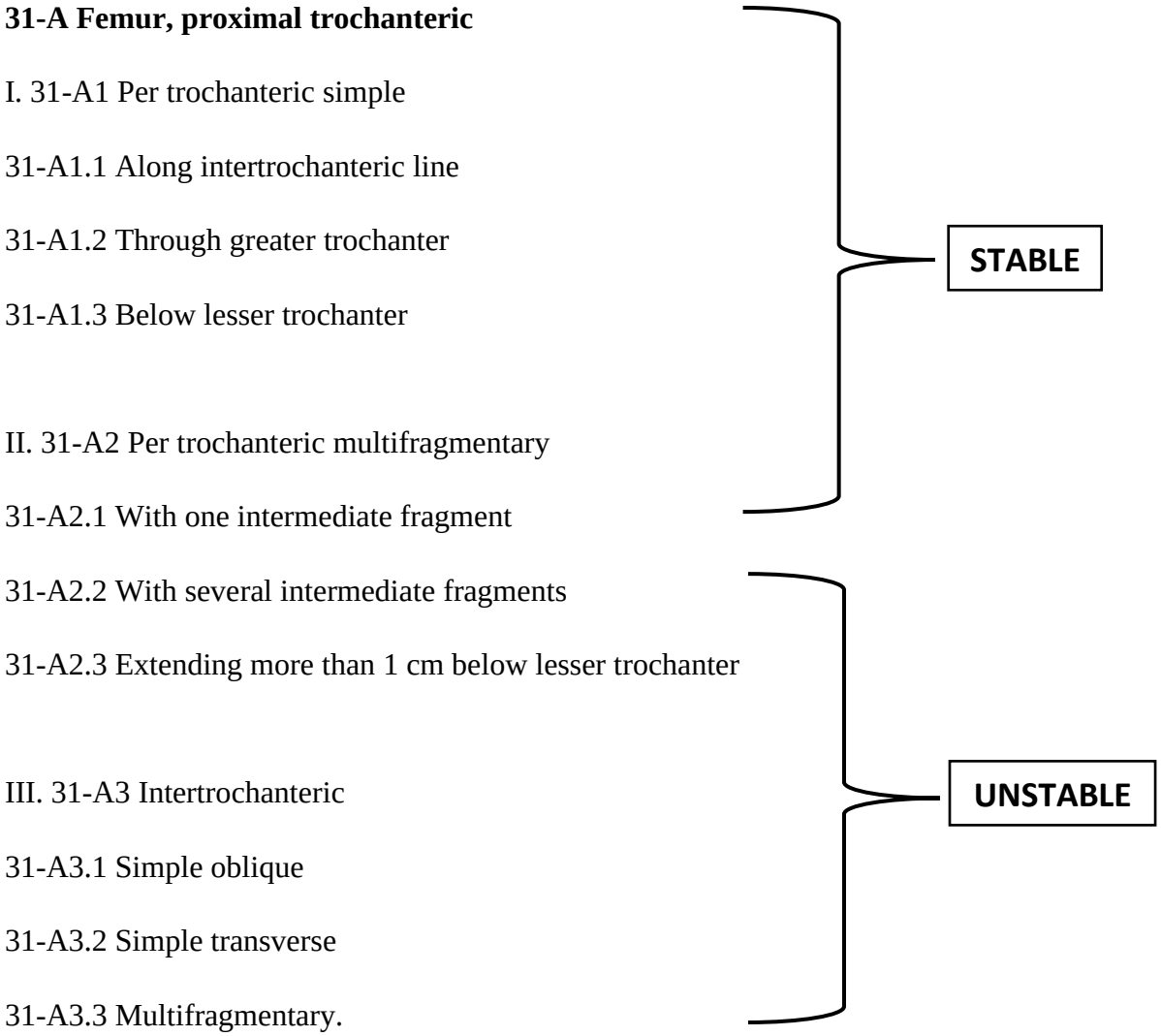
Various classifications have been proposed over years described the fracture patterns, focusing on importance of posteriomedial and lateral wall for stability. Tronzo classification is found to be less reliable and not useful in clinical practice. AO/OTA and Dr G.S. Kulkarni et al modified classification has described in detail the preferred implant according to the fracture type. An AO/OTA group has good reliability but subgroup assessment has poor reliability; it is more useful in record keeping, deciding management and research. Kulkarni et al classification is found to be more simple & easy to apply in practice, record keeping and research. There is still no consensus on the best classification but with new biomechanical informations coming through, the classification systems would continue to evolve.

In the Comprehensive Classification of Fractures of the Long Bones, Müller and colleagues coded proximal hip fractures to offer a uniform alphanumeric fracture classification. This system was advocated by the AO/ASIF, and later adopted by OTA in their Fracture Compendium.

According to AO/OTA alphanumeric classification intertrochanteric fractures (Type 31A) Bone = femur = 3, Segment = proximal = 1, Type = A1, A2, A3 A1: simple (two-part) fractures, with the typical oblique fracture line extending from the greater trochanter to the medial cortex; the lateral cortex of the greater trochanter remains intact.

A2: fractures are comminuted with a posteromedial fragment; the lateral cortex of the greater trochanter, however, remains intact. Fractures in this group are generally unstable, depending on the size of the medial fragment

A3: fractures are those in which the fracture line extends across both the medial and lateral cortices; this group includes the reverse obliquity pattern or sub trochanteric extensions.



Clinical importance:

This helps in predicting prognosis and suggests treatment for the entire spectrum of IT fractures. Fractures A1.1 through A2.1 are commonly described as stable, and fractures A2.2 through A3.3 usually are unstable.

Anirudh Sharma et al from India compare the Clinico-Radiological Outcomes with Proximal Femoral Nail (PFN) and Proximal Femoral Nail Anti-rotation (PFNA) in Fixation of Unstable Intertrochanteric Fractures using an eighteen-month prospective comparative study from 1st December 2013 to 1st June 2015 conducted in the Department of Orthopaedics, Christian Medical College and Hospital, Ludhiana, Punjab, India, concluded that the functional outcomes achieved with both implants are similar, number of implant-related complications were fewer with PFNA, even in an osteoporotic group. They recommend the use of the PFNA in unstable fractures, especially in the elderly osteoporotic population. (14)

Xiaowei Huang et al from China studied the Biomechanical comparison of the dynamic hip screw (DHS) and Gamma nail for the treatment of unstable intertrochanteric fractures using a 3D finite element model of the intact proximal femur was constructed, from which two types of fractured models concluded that for the unstable fracture, DHS maybe not suitable because it failed to maintain the integrity of the calcar region and showed larger displacement of fractured fragment. Also, they stated that the Gamma nail has mechanical superiority over DHS, but the shielding effect accompanied may increase the risk of intra-operative and later fracture around or below the implant. When the integrity of the calcar region fails to maintain, the Gamma nail is preferred. (5)

DK Kwak et al from Korea studied biomechanical comparison of three different intramedullary nails for fixation of unstable basicervical intertrochanteric fractures of the proximal femur using experimental studies concluded that screw-blade hybrid type and blade type would be more effective in minimizing rotation instability of the proximal fragment in unstable basicervical intertrochanteric fractures. Also, they stated that varus collapse of the proximal fragment and cranial and axial migration within the femoral head was greater with blade type than screw-blade hybrid type. (15)

Mallya et al from India comparing the radiological and functional outcome of unstable intertrochanteric femur fractures treated using PFN and PFNA-2 using a descriptive longitudinal study concluded that the functional outcome achieved with both implants was similar. Also, they stated that the overall complications, in the set-up of osteoporosis, seen with both implants were similar, but the PFNA2 group showed better results in terms of perioperative morbidity. (16)

M Raj et al from India evaluated the clinical results and complications of internal fixation of Intertrochanteric femur fracture with proximal femoral nail anti-rotation on 30 patients presented with Intertrochanteric femur fracture concluded that Proximal femoral nail anti-rotation (PFNA) represents a significant treatment option in the management of intertrochanteric fractures with low complication rate. (17)

Wang et al from China using network meta-analysis of surgical treatment for unstable femoral intertrochanteric fractures concluded that PFNA is the better surgical method than a dynamic hip screw (DHS) for unstable femoral intertrochanteric fractures. (18)

S Sadic et al from Bosnia and Herzegovina studied Proximal Femoral Nail Antirotation in Treatment of intertrochanteric hip fractures: a retrospective study in 113 patients concluded that PFNA offers biomechanical advantages, but the best position of the blade is still unknown. (19)

GNK Kumar et al from India studied the Treatment of Unstable Intertrochanteric Fractures with Proximal Femoral Nail Antirotation II using a retrospective study concluded that PFNA II is recommended for fixation of unstable intertrochanteric fractures with less operative time and low complication rate. They also stated that proper operative technique is important for achieving fracture stability and to avoid major complications. (20)

Objectives:

General objectives:

To evaluate the early Functional outcome of proximal femoral nail anti-rotation in the treatment of unstable intertrochanteric fractures

Specific objectives:

After three months post-surgery by using modified Harris hip score (mHHS)

1. To assess the hip pain after 3 months post-surgery.
2. To evaluate (limp, distance walked, and support).
3. To assess (climbing stairs, shoes, and socks, sitting, and public transportation).
4. To correlate between demographic features and total functional outcome.

Materials and Methods

Study design:

Descriptive cross-sectional hospital-based study.

Study setting:

Multi-center study, conducted in three hospitals:

Alkweity specialized hospital - Khartoum state.

Sharg Elneel hospital, Khartoum state - Khartoum north.

Alamal hospital, Khartoum state - Khartoum north.

Study duration:

Three hundred days (300 days)

From December 2019 to December 2020

Study population:

All patients including in the study had unstable intertrochanteric fracture treated by proximal femoral nail anti-rotation

Inclusion criteria:

Any patient with unstable intertrochanteric fracture. The A.O. alphanumeric classification was used to classify the fractures (fractures A2.2 through A3.3) treated by proximal femoral nail anti-rotation.

Exclusion criteria:

Revision surgery

Open unstable intertrochanteric fractures

Skeletally immature patients

Sample size and Technique:

All available patients in the 3 centre of study during study period and fulfil the criteria included, and the total number in our study was 40 cases. There are published articles with similar number of cases in the literature.

Data collection tools and methods:

Data collection:

Data collected through questionnaire including patient data, and postoperative history using modified HARRIS HIP SCORE.

The data collected by the researcher by the software epi-info program.

Data analysis:

The data analyzed using the Statistical Package of Social Sciences (SPSS) version 26.

Study variables:

Dependent variables	**Independent variables**
Mean mHHS	Gender
Post-operative pain score	Age Group
Limping score	Operated Hip
Support	
Distance walked	
Stair	
Socks/shoes	
Sitting	
Public transportation	

Data management

In our Descriptive cross-sectional study, Statistical analysis was done using SPSS software (IBM Version-26). Categorical variables were compared using the Chi-square test. Statistical significance was set at a P-value of 0.05 or less.

Ethical Consideration:

The study protocol was approved by the ethical committee of SMSB, and EDC.

Informed oral and written consent was obtained from each patient before participation in the study.

Results

Forty patients with an unstable intertrochanteric femur fracture (fractures A2.2 through A3.3), operated with PFNA, were enrolled in the study There were 22 males and 18 females included in this study. Right hip: 24 patients, left hip: 16 patients. The age was classified according to the WHO classification young adults 5, middle-aged adults 3, and old adults 32. The mean age was 65.45.

We used the modified Harris Hip Score to assess postoperative pain, function, and functional activities. 31 patients had no pain (table 1), 24 had slight limping (table 2), 13 used a cane for a long walk (table 3), 18 walked for 2-3 blocks (table 4), 21 climbed the stairs normally with banisters (table 5), 29 can put on stocks/shoes (table 6), 38 sat at any chair for one hour (table 7), 25 able to use public transportation (table 8).

Pain score	Frequency	Percent
None/ignores	31	77.5
Slight, occasional, no compromise inactivity	9	22.5
Total	40	100.0

Table 1 shows post-operative pain score, frequency and percentage.

Limp	Frequency	Percent
Moderate	8	20.0
None	6	15.0
Severe	1	2.5
Slight	24	60.0
Unable to walk	1	2.5
Total	40	100.0

Table 2 shows Post-operative limping score, frequency and percentage.

Support	Frequency	Percent
2 canes	5	12.5
2 crutches	1	2.5
Cane, full time	10	25.0
Cane long walks	13	32.5
Crutch	2	5.0
None	8	20.0
Unable to walk	1	2.5
Total	40	100.0

Table 3 shows Post-operative support score, frequency and percentage.

Distance Walked	Frequency	Percent
2-3 blocks	18	45.0
6 blocks	5	12.5
Bed and chair	1	2.5
Indoors only	9	22.5
Unlimited	7	17.5
Total	40	100.0

Table 4 shows Post-operative Distances Walked, frequency and percentage

Stairs	Frequency	Percent
Any method	8	20.0
Normally	8	20.0
Normally with banister	21	52.5
Not able	3	7.5
Total	40	100.0

Table 5 shows Post-operative stairs climbing, frequency and percentage.

Socks /Shoes	Frequency	Percent
With difficulty	11	27.5
With ease	29	72.5
Total	40	100.0

Table 6 shows Post-operative put on Socks Shoes, frequency and percentage.

Sitting	Frequency	Percent
Any chair, 1 hour	38	95.0
High chair, ½ hour	2	5.0
Total	40	100.0

Table 7 shows Post-operative Sitting, frequency and percentage.

Public Transportation	Frequency	Percent
Able to enter public transportation	25	62.5
Unable to use public transportation	15	37.5
Total	40	100.0

Table 8 shows Post-operative Public Transportation, frequency and percentage.

Modified Harris Hip Score (mHHS) was categorized into four groups less than 70 (poor), 70-79 (fair), 80-89 (good), more than 90 (excellent). Most of the patients are scored fair (12) and good (17). Table 10

Modified Harris Hip Score(mHHS)	Frequency	Percent
Poor	5	12.5
Fair	12	30.0
Good	17	42.5
Excellent	6	15.0
Total	40	100.0

Table 9 shows Post-operative Modified Harris Hip Score (mHHS), frequency and percentage.

Association between mHHS and demographic data done by crosstabs using Pearson Chi-Square test. There is a statistically significant difference between the mHHS and the age group, The functional outcome was excellent in young patient and the more patient's age the less functional outcome (Table 10) and gender, Most of our patients score were fair and good. 17 female patients are fallen in this category while 12 male patients. All excellent patients are male group. (Table 11) with a p-value of 0.000 and .031 respectively. And we found no relation between the operated hip and the final mHHS of the patient a p-value of .252.

			Age Group			Total
			young adults	middle-aged adults	old adults	
MHHS	Poor	Count	0	0	5	5
		% within Age Group	0.0%	0.0%	15.6%	12.5%
	Fair	Count	0	2	**10**	12
		% within Age Group	0.0%	66.7%	**31.3%**	30.0%
	Good	Count	1	0	**16**	17
		% within Age Group	20.0%	0.0%	**50.0%**	42.5%
	Excellent	Count	**4**	1	1	6
		% within Age Group	**80.0%**	33.3%	3.1%	15.0%
Total		Count	5	3	32	40
		% within Age Group	100.0%	100.0%	100.0%	100.0%

Table 10 shows Association between mHHS and Age Group, frequency and percentage.

P-value of 0.000

			Gender		Total
			Female	Male	
MHHS	Poor	Count	1	4	5
		% within Gender	5.6%	18.2%	12.5%
	Fair	Count	**8**	4	12
		% within Gender	**44.4%**	18.2%	30.0%
	Good	Count	**9**	8	17
		% within Gender	**50.0%**	36.4%	42.5%
	Excellent	Count	0	**6**	6
		% within Gender	0.0%	**27.3%**	15.0%
Total		Count	18	22	40
		% within Gender	100.0%	100.0%	100.0%

Table 11 shows Association between mHHS and Gender, frequency and percentage.

P-value of 0.031.

Discussion

The incidence of unstable intertrochanteric fractures is increasing and this trend is likely to continue. These fractures are challenging for an average orthopedic surgeon. Treatment modalities include osteosynthesis with dynamic hip screws and cephalomedullary nails and in selected cases, arthroplasty. However, the choice of implant for unstable intertrochanteric fractures is still debatable.

Our study aims to evaluate the functional outcome of proximal femoral nail anti-rotation in treatment of unstable intertrochanteric fractures, conducted as multicentre hospital-based (Kwuety specialized hospital, Sharg Elneel Hospital, and Alamal hospital) study, covered 40 patients in agreement with Mallya S, et al. studied 78 patients, 37 PFNA group. Comparison of radiological and functional outcome of unstable intertrochanteric femur fractures treated using PFN and PFNA-2 in patients with osteoporosis. (16).

In our study, the modified Harris Hip Score (mHHS) was classified into poor < 70, fair 70-79, good 80-89, and excellent > 90 and obtained from each patient after 3 months post-operatively. 17 (42.5%) were good, 12 (30%), 6 (15%) were excellent and 5 (12.5) were poor score results, fair and good results accounted for 72.5%. The mean mHHS of our patients after three months was 80.52. +/- 11.204.Our mean mHHS correspond to mean mHHS of Vishwanathan K, et al. 2018 Mar. after six month, as their

study revealed the mean mHHS at one month, three months, and six postoperatively was 39.9 ± 9.5, 61.6 ± 14.7, and 81 ± 15.9 respectively. (12) And Sharma A, et al. 2017 Jul 1. their mean HHS at final follow up 78.85 and poor 22.7%, fair 27.2, good 36.3, and excellent result 13.6%. (14)

In our study 31 patients (77.5%) had no pain and only 9 patients (22.5%) had slight pain that didn't affect their daily activity and no patient used analgesia. In comparison to the study done by Tang P, et al. Injury. Volume 43, Issue 6, June 2012. They found that more hip pain (although not serious) was found in PFNA patients even though the Asian PFNA has a better fit for the smaller trochanteric area and the narrower intramedullary canal of the Asian population. (17) Another study was done by Pu JS, et al. International orthopaedics. 2009 Oct 1; 33(5):1441-4. Founded that when the patients started to walk or mobilize, the prominent proximal end of the nail irritated the soft tissue of the hip resulting in thigh pain and discomfort. (21)

In our study we found that 24 patients (60%) had slight limping that didn't affect their walking or causing discomfort, 8 patients (20%) had moderate limping, 6 patients (15%) had walking normally without limping, 1 patient (2.5%) had severe limping that affected the daily activity and 1 patient (2.5%) unable to walk. While Kothiyal P, et al. Int J Orthop Sci. 2017;3(3):980-5, they found that The limping was all the time among all the patients at one month. However, the limping was found often in 46.8% at 3 months and sometimes in 57.4% at 6 months and 53.2% at 12 months. (22)

In our study we found that 13 patients (32.5%) used a cane for long walks, 10 patients (25%) used a cane for full time, 8 patients (20%) walked independently, 5 patients (12.5) used 2 canes, 2 patients (5%) used one crutch, one patient (2.5%) used 2 crutches and one patient (2.5%) unable to walk, comparable to Pu JS, et al. They found that 67 patients (77%) were fully weight-bearing and recovered their pre-injury activity levels, ten (11.5%) walked with two crutches and two (2.3%) used a wheelchair. (21)

In our study we found that 18 patients (45%) walked 2-3 blocks, 9 patients (22.5) walked indoors only, 7 patients (17.5) walked for unlimited distances, 5 patients (12.5%) walked 6 blocks and only one patient (2.5%) walked between bed and chair, in compare to Hélin M, et al: Surgery & Research. 2015 Feb 1;101(1):45-9. found that Parker scores were significantly lower in unstable fracture at baseline then fell considerably by time. (23)

In our study 21 patients (52.5%) climbed the stair normally with a banister, 8 patients (20%) climbed normally, 8 patients (20%) climbed by any method, and 3 patients (7.5%) unable to climb the stairs, while Kothiyal P, Vij K, et al 2017;3(3):980-5, found that All the patients were not able to climb a

flight of stairs at one month. However, 42.6% were able with moderate difficulty to climb a flight of stairs at 3 months, with little difficulty (66%) at 6 months, and 51.1% at 12 months. (22)

In our study we evaluated the functional activities of the patients by mHHS (wearing socks/shoes, sitting and public transportation), we found that 29 patients (72.5%) put on socks/shoes with ease, 11 patients (27.5%) with difficulty, 38 of patients (95%) sat at any chair for one hour, 2 patients (5%) on high chair for half an hour, 25 patients (62.5%) able to enter the public transportation and 15 patients (37.5%) unable to enter public transportation. Comparable to Tang P, et al. Found that the functional aspects evaluated by the Harris Hip Score, although PFNA seemed to be better, no significant difference was found statistically. However, the details of Harris Hip Score items were quite different: pain: $P < 0.001$, walking support: $P = 0.001$, walking distance: $P = 0.009$, stairs: $P < 0.001$, shoes and socks: $P = 0.022$, sitting: $P = 0.034$, transportation: $P = 0.006$. An interesting result emerged: PFNA had superiority over hemiarthroplasty in most subjects but was poor in the pain aspect. (24)

Our study result showed a strong significant association between age group and mHHS p-value 0.000, most of the old adult patients fall between good 50% and fair 31.3% outcome, 80% of young adults had an excellent outcome and 20% had a good outcome, 66.7% of middle-aged adults had a fair outcome. Also, there is a significant association between mHHS and gender with a p-value of 0.031, 4 (18.2%) of male patients had a poor outcome, 4 (18.2%) had fair outcome, 8 (36.4%) had a good outcome, and 6 (27.3%) had excellent outcome, while we had 1 (5.6%) female patient had a poor outcome, 8 (44.4%) had fair outcome, 9 (50%) had a good outcome and no female patient had an excellent outcome. But there is no relationship between operated hip and mHHS p-value 0.252. In comparison to the study done by Vinoth Kumar G. Showed the average HARRIS HIP SCORE in their patients was 79.8 (at the end of three months) and 82.3 (at the end of six months). Most of them were graded as “good” as per HARRIS HIP SCORING. Fair scores were seen with higher age group, "good" outcome was seen in most of the patients. The fair outcome was seen in patients above the age group of 65 only. (25) Another study was done by Ghilzai AK, et al 2018;2(1):2145-9. Their result showed no significant association of functional outcome was observed with gender (p=0.289), age (p=0.127), type of fracture (p=513), and mode of admission (p=0.662) as p-value found statistically insignificant. (26)

Limitations

This study has the limitations of being a small sample size and limited centres because the operated patients in the study period were very difficult to reach due to numerous factors including COVID 19 pandemic and they lost their follow up. Also short period of follow up (three months), and our study design as cross sectional we cannot comment on the long term functional outcome

Conclusion

Unstable intertrochanteric fracture is common in the elderly due to osteoporosis and in the young due to high-velocity trauma. As the fracture is more common in the elderly 80% of our study group, early reduction and internal fixation increases patient comfort, facilitates nursing care, helps in the early mobilization of the patient. We believed our study had shown that the PFNA works well in the treatment of unstable intertrochanteric fractures, post-operative pain was ignored in most of our patients, 60% had slight limping not compromised their daily activity, most of them used a cane for walking 2-3 blocks, 52.5% climbed the stairs with banister, 72.5% put on socks/shoes with ease, 95.0% sitting in any chair for a long time and 62.5% entered public transportation. The overall functional outcome of our patients falls between good and fair.

Recommendations

1. A further study soon with large sample size, multicenter, follow up the patients at specific intervals and notational level is needed.
2. Further study for clinical and radiological outcomes of proximal femoral nail anti-rotation is needed.
3. Pre-operative assessment of mHHS and nearby joints, to predict the future functional and clinical outcome is needed.

Abbreviations

COVID 19	Coronavirus disease 2019
EDC	Educational development center
DHS	Dynamic hip screw
IMN	Intramedullary nail
mHHS	Modified Harris hip score

PFNA	Proximal femoral nail anti-rotation
PFN	Proximal femoral nail
SMSB	Sudan medical specialization board
SPSS	Statistical package of social sciences
WHO	World health organization

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