



Title-Functional Outcome,Radiological union and Associated complication of Unstable Traumatic Inter-trochanteric Fractures treated with Cephalomedullary Nails at Tikur Anbessa Specialized Hospital , Addis Ababa University.

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List of- Acronyms and Abbreviations

AAU-Addis Ababa University

TASH-Tikur Anbessa Specialized Hospital

PI –principal investigator

SPSS-Statistical Package for service solution

MD-Medical Doctor

MHHS-Modified Harris Hip score

MRN-medical record number

CMN-Cephalo-medullary Nail

IMN-intra-medullary nail

SIGN-Surgical implant generation network

IT-Intertrochanteric fractures

Summary

Background:-Femur is the largest and strongest long bone in human skeleton. The proximal part of the femur includes three parts; Femur neck which is intra-capsular part of the proximal Femur, Inter-trochanteric area which includes the region between greater and lesser trochanter, and sub-trochanteric area which is within 5cm below the lesser trochanter. Proximal femur fracture is a common fracture in the elderly population following simple ground level fall down and also common in the young population following high energy injury. The prevalence of proximal femur fracture in the senior population is increasing alarmingly recently as the life expectancy is increasing.

Being the largest and tertiary referral hospital, Tikur Anbessa specialized hospital receives and treats a lot of both elderly and young patients with proximal femur fracture from all over the country. Almost all of these patients, unless they have clear contra-indication for surgery, were treated with some form of surgical intervention. Some of the surgical methods used to treat proximal femur fracture in our setup include Sliding hip screw, Cephalo-medullary nails, Cannulated hip screw, Angle blade plates, SIGN intra-medullary nails, Hemi-arthroplasty and total hip arthroplasty. Clinical study on Functional and Radiological outcome of patients following Cephalo-medullary nail fixation for Proximal Femur fracture and associated complications was first in its type both in our center and country.

Objective:-The main objective of this study is to know Functional outcome and radiological union of patients with Unstable Traumatic inter-trochanteric Fractures fixed with Cephalo-medullary Nail and its associated complications at TASH, AAU.

Methods:-A single center Cross-sectional retrospective study design was used for the purpose of this research. All patients for whom CMN was done for proximal femur fracture since 2018 G.C to August 2024 G.C were collected from Operation theatre log book and Orthopaedics and Trauma surgery department daily operation theatre schedule and were included in to this study if they full-fill the inclusion criteria of the study. The data was collected using the Questionnaires developed by the principal investigator and Modified harris hip score. The data was entered using Epi Info and analyzed using SPSS version 27. Descriptive statistics was used to describe socio-demographic status of patients. Graphs, pie charts and tables were used for presentation of results.

Bivariate correlation was used to study the relation between dependent and independent variables. Ethical clearance was obtained from the research ethical review board (IRB) of Tikur Anbessa Specialized Hospital, TASH Addis Ababa University.

Result:-Among 127 study participants 65.35% were males. About 32.3% of the study participants were aged 50years or younger(15.7% were 51-60years,18.9% were 61-70years,23.6% were 71-80years and 9.4% were older than 80years).Falling down injury was the commonest cause of proximal femur fracture in our study accounting for about 66.14% followed by road traffic injury which accounts for about 26.77%.According to our study functional outcome of our patients using modified Harris hip score shows that only about 52.8% of the participants had good and excellent functional outcome.26% of the participants had poor outcome and 21.2% had fair functional outcome. All study participants had achieved radiologic union. The most common complication identified in our patients for whom cephalo-medullary nailing was done for an indication of unstable traumatic intertrochanteric fracture were post op infection(8.7%),helical blade back out (7.9%),and re-operation with in first year of surgery was done in about 3.9% of the participants. Age of the patient, patients with comorbidity and helical blade back out were found to have significant positive correlation with modified Harris hip score of the patients.1year mortality in patients for whom cephalo-medullary nailing was done for unstable traumatic IT fracture was about 17.3%.Older patients with one or more comorbidity were more likely to die within 1year after cephalomedullary was done for proximal femur fractures.

Conclusion:-About 24% of the study participants had excellent functional outcome using modified Harris hip score and 28.8% of the study participants had good functional outcome. The remaining 47.2% of the study participants had fair and poor patient reported functional outcome as measured using Modified harris hip score. All study participants for whom cephalo-medullary nailing was done for an indication of Unstable traumatic IT fractures had achieved radiologic union with in 1year of surgical intervention. Post op infection and helical blade back out were the two commonest complications identified in our study participants.

Keywords-Functional outcome, Modified Harris hip score, Proximal femur fracture

1.Introduction

1.1 Background of the study

Proximal Femur fracture is common injury both in developed and developing countries. As the percentage of aging population increases the number of patients with proximal femur fracture is also increasing.[1] Proximal femur fracture in general has bimodal distribution; it usually results from high energy injury in the younger population and occurs following low energy ground level fall down accident in the elderly osteoporotic group of population. Proximal femur fracture broadly includes intra-capsular fractures (femur neck fractures) and extra-capsular fractures which includes inter-trochanteric and sub-trochanteric fractures. The incidence of both groups of fractures is comparable; each accounting for 50%. Sub-trochanteric fracture accounts for only 5-10% of proximal femur fractures.[1], [2], [3]

Epidemiologic studies shows patients with inter-trochanteric fracture tend to be older and sicker than those with femur neck fractures; probably due to poor protective reflexes in elderly fragile group of population. They tend to fall on their side and land on their greater trochanteric area and got Inter-trochanteric fracture. [2], [4]

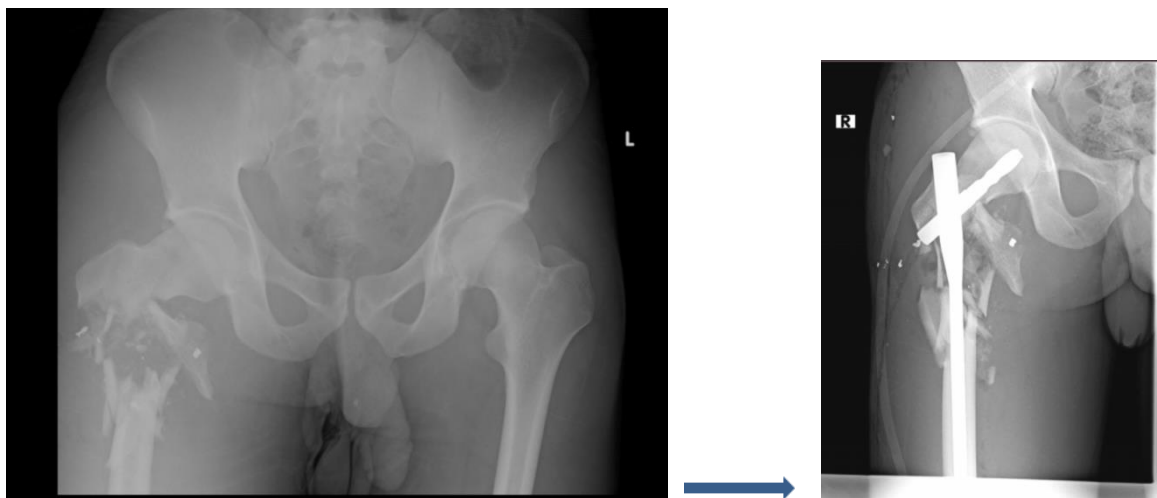
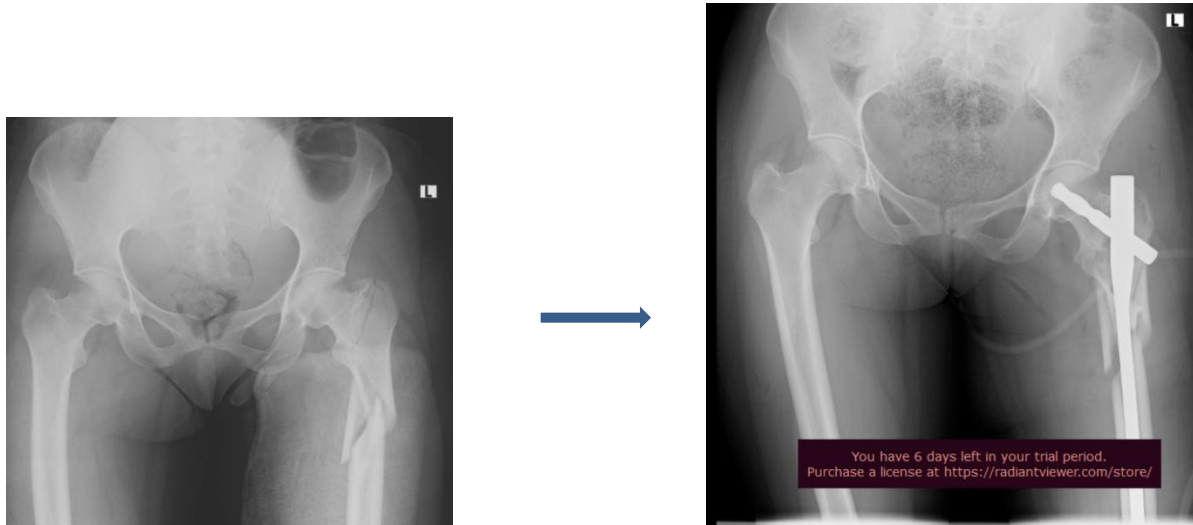
Proximal Femur fractures most commonly occurs in the elderly white women. Other risk factors include osteoporosis, excessive alcohol consumption, physical inactivity, caffeine, low body mass, maternal history of hip fractures, residence in the institution, previous hip fractures, visual impairment, psychotropic medications and dementia.[5], [6], [7]

Hip fractures were associated with significant economic burden to the patient, family, hospital and country at large. They were also associated with significant complication like thrombo-embolism, bed sore, Urinary tract infection and pneumonia. One year mortality following hip fractures in the elderly population could be as high as 20-30%. In order to prevent or decrease this complications hip fracture in the elderly needs multi-disciplinary approach, which includes internist, geriatricians, orthopaedics surgeons, anesthesiologist, physiotherapist and strong nursing team. The main stay of treatment in-order to prevent associated complication and death is early medical optimization, early surgical intervention ,early rehabilitation and ambulation.[2], [6], [7], [8], [9], [10]

Proximal femur fractures could be easily diagnosed based on the clinical history and physical examination findings. Simple x ray examination; AP pelvic x ray and lateral hip x ray usually suffice to diagnose hip fractures and it is usually enough to classify the type of fracture as well. But sometimes we need to have further investigations like bone scan and MRI when x ray is negative but we have strong clinical suspicion of hip fracture based on the clinical history and physical examination finding. Computed tomography also had a role for surgical planning in complex proximal femur fractures.[4], [11][1]

Intra-capsular and extra-capsular proximal femur fractures were treated differently. Intra-capsular proximal femur fractures were prone to complications like non-union and avascular necrosis, so the management is primarily dependent on physiologic age of the patient, bone quality, degree of initial displacement, comminution and availability of the options. Accordingly the options include fixation with implants like cannulated hip screw or Sliding hip screw; or hip replacement like hemi-arthroplasty or total hip arthroplasty. Inter-trochanteric area of proximal femur had abundant blood supply, so complications that are common in the femur neck fractures like non-union and Avascular necrosis were not common in inter-trochanteric fractures, rather inter-trochanteric fractures were prone to malunion and implant failure if not managed properly. The management options for inter-trochanteric fractures includes Sliding hip screw, Dynamic condylar screw, Angle blade plate, proximal femoral locking plates, Different types of intramedullary nails and sometimes hip replacement is the only option.[2], [4], [7], [11], [12], [13], [14], [15]

The Following images are prototype cases for which we routinely do Cephloedullary fixation.



1.2 Statement of the problem

Proximal femur fracture is primarily a surgical problem. Delay to the surgical intervention due to late patient presentation or due to some medical problems usually result in a number of complications and poor outcome. The earlier the surgical intervention usually within 48hrs of the injury the better will be the outcome. The main indication for Cephalo-medullary nailing or Intra-medullary nailing following proximal femur fracture is inter-trochanteric and sub-trochanteric fractures.

Stable inter-trochanteric fractures could be successfully treated with sliding hip screw and they have comparable outcome with intra-medullary fixation implants. Unstable inter-trochanteric fractures could be treated with both sliding hip screw and intra-medullary nails. Although there is a trend toward using intra-medullary nail implants in inter-trochanteric fractures especially in unstable inter-trochanteric fractures, there is no strong clinical evidence to use nail over SHS in inter-trochanteric fractures. Both of them have their cons and pros.[3], [13], [15], [16], [17], [18]

Tikur Anbessa Specialized Hospital, college of health science is referral tertiary public hospital and teaching hospital based in capital city Addis Ababa. It receives referral patients from all corner of the country. Proximal femur fractures were one of the common fractures treated in our hospital. The most commonly used implant for inter-trochanteric fractures in our hospital is Sliding hip screw, Cephalo-medullary nail (of sharma company), angle blade plate and dynamic condylar screw. We started to use SHARMA CMN in 2018G.C and it is the only intra-medullary implant we have in our center for fixing proximal femur fractures.

We studied Functional outcome and Radiological union of Unstable traumatic Intertrochanteric fractures fixed with CMN and associated complications at TASH, Addis Ababa University. This study was done in the Department of orthopaedics and trauma surgery, TASH, Addis Ababa University.

1.3 Rationale of the study

There was no study done in our country to assess the Functional outcome and Radiologic union of patients with proximal femur fracture treated with cephalo-medullary nail and complications associated with this method of treatment. So this study helped us know outcome of our patients ; both clinical outcome and radiological union following Cephalo-medullary fixation for Proximal femur fractures. It also helped us know the common complication associated with this mode of management. Knowing the common complication associated with this mode of treatment is important to proactively prevent this complication. We also compared the functional outcome of our patients with international studies .So this study helped us to know the functional outcome of our patients with hip fracture treated with CMN relative to the studies done in other part of the world.

There was no specific studies done to know if there is any specific complication associated with SHARM CMN in English literature. So this study helped us to look for any complications specific to this implant if there is any.

2. Literature Review

Hip fractures are one of the top 10 causes of disability world-wide. Hip fractures are classified anatomically relative to hip capsule in to intra-capsular (i.e femur neck) and extra-capsular fractures(i.e inter-trochanteric and sub-trochanteric fractures).[5] Patients with hip fracture had increased risk of mortality at 30days and 1year when compared to their healthy counterpart.

Inter-trochanteric fractures account for about 50% of the hip fractures. Dynamic hip screw was the main stay of treatment previously, but nowadays the use of intramedullary implants had increased significantly. A prospective comparative study was done in India from 2014-2016G.C by Pro. Pradeep Kamboj and colleges to study the functional outcome and Radiological outcome of inter-trochanteric fractures by Dynamic hip screw and Proximal femoral nailing. They randomly assigned 21patients in to each group to look if there is difference between the two groups. They found patients who were treated with CMN had less mean blood loss, less mean limb length discrepancy, and they gain better functional result at 6months. Intra-operative radiation exposure was more in PFN group, while there was no significant difference in radiological union, neck shaft angle and implant sliding in both groups. So, they conclude PFN was better than DHS in management of intertrochanteric fractures in terms of perioperative parameters (decreased blood loss, less complications), and as well as in functional outcomes (early weight bearing and mobilization, better Harris hip scores), while other parameters are not significantly different.[19]

Another study done in December 2013, at Singapore hospital to study cephalo-medullary nail versus Dynamic hip screw for Unstable inter-trochanteric fracture in the elderly patients with good pre-fracture ambulatory function stabilized with the PFNA resulted in better short-term ambulatory function. They found early stabilization of unstable intertrochanteric fractures with mechanically more stable implants (such as the PFNA) enables earlier weight bearing, recovery of ambulatory function, and return to pre-fracture social and community function.[15]

Another study done in 2017 in Dehradun, India to study functional outcome of patients with proximal femur fractures treated with cephalo-medullary nail by Oxford hip score.They followed 94 patients for whom CMN was done for at least 1year.They found uneventful post op recovery in all patients. No significant difference in harris hip score was seen in patients managed by long nails and short nails. Although cephalo-medullary nailing in proximal femoral fractures is a bit technically demanding it has the advantage of providing rotational as well as axial stability and excellent clinical results allowing a faster post-operative restoration of walking ability, with overall better outcome. According to this study, Cephalomedullary femoral nailing has the

advantage of providing rotational as well as axial stability in cases of these proximal femoral fractures allowing a faster post-operative restoration of walking ability, with overall better outcome as assessed by oxford hip score.[20]

In 2021 G.C study is done at Dr. Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik, Maharashtra, India on functional outcome of Intertrochanteric Femur Fracture Fixation using Proximal Femur Nail. They did prospective study on 127 patients aged 18years and above who have inter-trochanteric fractures with or without sub-trochanteric extension. Patients were followed for 6months duration and Functional outcome was assessed using a physician based scoring system i.e. Harris Hip Score. They found Fair' results in 17(13.4%), 'Good' results in 61(48.0%), 'Excellent' results were seen in 37(29.1%) patients at the end of 6 months follow up. This study shows that, PFN is an excellent implant for the treatment of intertrochanteric fractures. With a proper technique, PFN gives excellent clinical results with fewer failure rates and complications. So as per this study PFN has satisfactory functional outcome with fewer complication rates at the ends of 6months. Majority of the patients have good to Excellent Functional outcome after surgery.

Similar study done in 2019 in Germany to identify functional outcome and associated complication of patients with inter-trochanteric fracture treated with intra-medullary nail. They studied 193 patients and their average age was 70years. Cephalomedullary nails were utilized in 176 and reconstruction nails in 17 patients. After the index procedure, 86% healed uneventfully. Nonunion development was observed in 6% and 5% had an unscheduled reoperation due to implant or fixation failure. Active smoking was reported in 16.6%. Current smokers had an increased nonunion risk compared to those who do not currently smoke (15.6% vs. 4.3%; $p = 0.016$). The femoral neck angle averaged $128.0^\circ \pm 5^\circ$. Fixation failure occurred in 11.1% of patients with a neck-shaft-angle $< 125^\circ$ compared to 2.6% (4/155) of patients with a neck-shaft angle $\geq 125^\circ$ ($p = 0.021$). Patients treated with a reconstruction nail required a second surgical intervention in 23.5%, which was no different compared to 25.0% in the cephalomedullary group ($p = 0.893$). In the cephalomedullary group, 4.5% developed a nonunion compared to 23.5% in the reconstruction group ($p = 0.002$). Painful hardware led to hardware removal in 8.8%. All of them were treated with a cephalomedullary device ($p = 0.180$). During the last office visit, two-thirds of the patients reported no or only mild pain but most patients had reduced hip range of

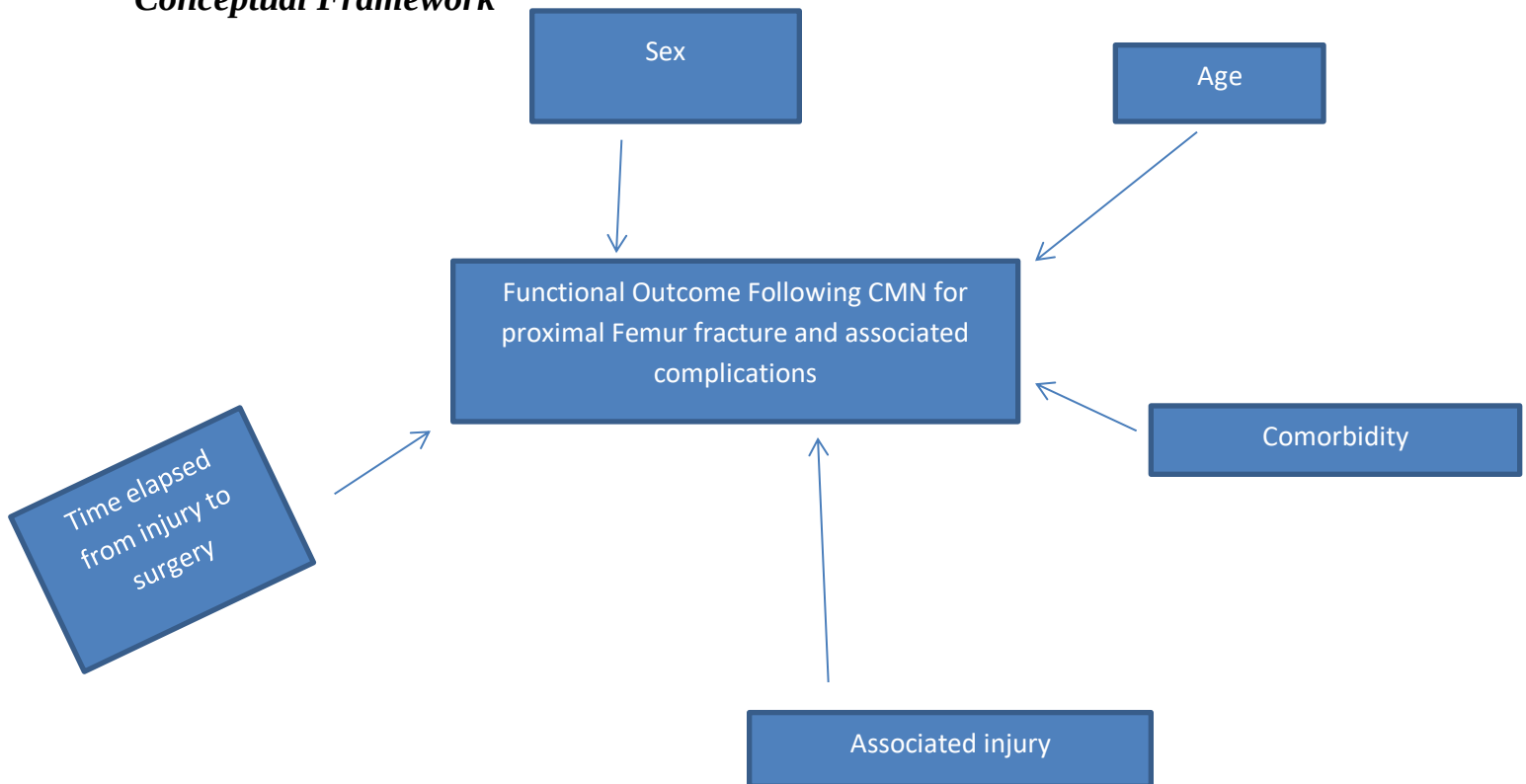
motion. According to this study, Intramedullary nailing is a reliable surgical technique when performed with adequate reduction. Varus reduction with a neck-shaft angle $< 125^\circ$ resulted in an increase in fixation failures.[21]

Another study done in Germany in 2018 to compare operative time, fluoroscopy time, intraoperative blood loss, blood transfusions, and perioperative complications; peri-implant fracture, malunion, reoperation, and death; and neck-shaft angle, tip-apex distance, and 6-month postoperative functional scores between long and intermediate CMN for pertrochanteric fracture. They found intermediate CMN group had shorter operative time (68 versus 92 min; $P=0.048$), shorter fluoroscopy time (72 versus 110 s; $P=0.019$), and less intraoperative blood loss (80 versus 168 mL; $P<0.001$) than the long CMN group. The groups were similar in rates of blood transfusion, perioperative complications, peri-implant fracture, malunion, reoperation, and death. Six-month postoperative functional scores were similar between groups. They found operative advantages of intermediate CMNs over long CMNs with no difference in treatment outcomes.[22]

In 2020 G.C Dr.Vivek Sodhai and his colleges at Sancheti Institute Of Orthopaedics and Rehabilitation, Pune, India studied function outcome of Cephalomedullary Nailing in the treatment of Extracapsular Proximal Femur Fractures and Factors Affecting it. They studied 140 patients, 52 had excellent while 88 had good HHS. Patient in age group 20-40 had an average HHS of 87.79, 40-60 age group had an average HHS of 87.41, while patients in age group > 60 years had an average HHS of 87.63. Patients achieved average full weight bearing at 9.94 ± 2.76 weeks (p-value 0.578). Change in the neck shaft angle (NSA) was statistically significant in the immediate post-operative and at 1- year radiographs.[23]

Study done in France in 2014, to study complications associated with short versus long CMN on 256 patients found Catastrophic failure and hardware complication rates were not statistically different between short or long cephalomedullary nails. The overall catastrophic failure rate was 3.1 %; there was a 5 % failure rate in the short nail group compared with a 2.6 % failure rate in the long nail group ($p = 0.191$). There was a 3.33 % secondary femur fracture rate in the short-nail group, compared with none in the long-nail cohort ($p = 0.054$). The rate of proximal fixation failure was 1.67 % for the short-nail group and 2.0 % in the long-nail group. So they found similar catastrophic failure rate between both short and long cephalomedullary nails for intertrochanteric femur fractures.[24]

Conceptual Framework



3. Objectives of the study

3.1 General Objective

The general objective of this study is to know the functional outcome, radiological union and associated complications of patients with unstable traumatic Intertrochanteric fractures fixed with CMN at TASH, AAU.

3.2 Specific Objective

1-To assess patient reported functional outcome following Cephalo-medullary nailing for Unstable traumatic IT fractures.

2-To assess radiologic union of Unstable IT fractures treated with cephalo-medullary nail

3-To identify common complications associated with cephalo-medullary nailing for proximal femur fractures.

4. Methods and Materials

4.1 Study Setting and Period

This study was conducted in Department of Orthopedics and Trauma Surgery ,College of health science, Addis Ababa University. College of health science ,TASH is one of the colleges under Addis Ababa University. Tikur Anbessa Specialized hospital is the largest tertiary referral hospital based in the capital city,Addis Ababa ,Ethiopia. TASH has been established in 1972 G.C. Currently TASH is providing more than 45 speciality and sub-speciality services to the patients referred from all over the country.

Tikur Anbessa Specialized hospital is providing medical education and training to both undergraduate and post-graduate medical students; who joins the university from all over the country and abroad as well. The hospital has more than 2731 permanent staffs. Currently the hospital has about 641 inpatient beds and 16 operation tables. Outpatient clinics serve on average 831,685 per year and about 69,307 clients per month. Averagely more than 12,500 major surgeries were performed annually. The hospital provides both emergency and elective clinical services to the needy patients 24hours a day the whole year. The study was conducted over 1year and 5months period starting from April 2024 G.C .

4.2 Study Design

Retrospective cross-sectional study was used for the purpose of this study.

4.3 Population

4.3.1 Source Population

All patients for whom Sharma cephalo-medullary nail was done for an indication of proximal femur fracture will be the source population.

4.3.2 Study Population

All patients for whom Sharma orthopedics (India) Pvt. CMN was done following proximal femur fractures were included in study population if they full-fill the inclusion criteria.

4.3.3 Study Unit

Each and every patient for whom Sharma Cephalo-medullary nailing was done and those who full-filled the inclusion criteria was the study unit.

4.3.4 Sampling Frame

The list of patients for whom Sharma Cephalo-medullary nailing was done following proximal femur fracture were collected from operation theatre logbook and Daily elective operation theatre schedule. All patients from the sampling frame who full-filled the inclusion criteria were included in to this study.

4.4 Eligibility Criteria

4.4.1 Inclusion Criteria

All patients aged 18years and above and for whom Sharma orthopedics(India) Cephalo-medullary nailing was done at Tikur Anbessa specialized hospital for proximal femur fracture were included in to this study.

4.4.2 Exclusion Criteria

Patients aged less than 18years who couldn't give consent and who have growing proximal femur were excluded from this study. Those patients who didn't have complete data and could not be reached were also not included in this study. Those patients for whom CMN was done following pathologic proximal femur fractures were not part of this research. Patients with major traumatic brain injury, spinal cord injury, pelvic and acetabular fractures, and major upper and lower extremity injury which could potentially affect the functional outcome of the patient were excluded. Patients with sub-trochanteric fracture and inter-trochanteric fracture with neck of femur extension were excluded from this study. Patients with inadequate follow-up were excluded also. Patients with major disabling comorbidities like End stage renal disease, Cardiac failure, major depressive disorders and others were not be included. The patients who were less than 1year since index surgery were excluded from the study.

4.5 Sample Size determination and Sampling Procedures

4.5.1 Sample Size Determination

For the purpose of this study all patients for whom Sharma orthopedics(India) CMN was done for an indication of proximal femur fracture in our hospital were included in to this study if they

full-fill the criteria. We registered around 310 patients for whom CMN was done at TASH during the study period. Using the exclusion criteria our final sample size is 127 patients.

4.5.2 Sampling Technique and Sampling Procedure

First all patients for whom Sharma CMN was done for an indication of proximal femur fractures were identified from operation theatre log book and orthopaedics and Trauma surgery daily operation theatre schedule. Then those patients who did not full-fill the inclusion criteria were excluded from the study. Then all of those who full-fill the inclusion criteria were used as a sample for this study.

4.6 Study Variables

Dependent variables-Functional outcome and Radiologic union following CMN fixation for Proximal Femur fracture and associated complications.

Independent variables-age

- sex
- comorbidity
- side of injury
- associated injury
- Type of nail used (short vs long)
- time elapsed from injury to surgery
- duration of surgery
- amount of blood loss
- presence or absence of complication

4.7 Operational Definitions

Age-In this study age includes those aged 18 years and above, for whom Sharma orthopaedics (India) CMN was done and who can give consent by themselves.

CMN-Cephalo-medullary nail in this study is the type of nail used for fixation of proximal femur fracture and it is the product of SHARMA orthopaedics(India) Pvt implants manufacturing company. It was the only Nail available for fixation of hip fractures at TASH ,AAU. Although different surgeons with different level of experience and training operate on the study participants ,all used the same type of Nail which is the product of Sharma Orthopedics(India).

Associated complication-refers to any complication that occur when CMN is done intra-op or post-op.

Post -op infection-If the patient is reported to have any sign of infection documented whether it is superficial infection which is treated with wound care and antibiotics only or deep infection which is treated with surgical debridement and antibiotics was considered as post op infection in this study.

Associated injury-is any minimal injury like clavicle fracture,phalanges fractures,or simple soft tissue injuries which were treated non operatively and healed successfully without sequele

Complete Follow up-For the purpose of this study the patient is said to have complete follow up only if they were on follow up for at least 1year from the time of surgery with complete radiologic follow-up.

4.8 Data Collection Method, Tool and Procedure

First patient name and medical record number were collected from operation theatre log book and Orthopaedics and Trauma Surgery daily operation theatre schedule. Then based on this data chart of patients were retrieved from card room. The data was collected from chart of patients,Electronic TASH patient database,TASH radiologic database and from patients themselves. The questionnaires prepared by principal investigator and MHHS were used to collect the data.

4.9 Data Quality Control

To ensure the quality of data, the questionnaire were pretested on 5% of the sample size before starting data collection. This Pre-test result was discussed with the advisors and all necessary amendments were made on the content ,order and grammar of the questionnaires. Throughout the data collection procedure two trained General medical practitioners and PI filled all the

questionnaires. The principal investigator supervised the data collection process and checked the data that is collected for completeness daily.

4.10 Data Processing and Analysis Plan

After completing data collection, data was checked by the principal investigator for completeness and coded. The coded data was entered in to Epi Info and exported to SPSS Version 26 for further analysis. Then analysis was done for functional outcome and radiologic union. Presence and frequency of complication associated with this method of treatment was also analysed. Graphs, pie charts and tables were used for presentation of results.

4.11 Ethical Consideration

Ethical approval and clearance was obtained from the research ethical review board (IRB) of Tikur Anbessa Specialized Hospital (TASH), college of health science Addis Ababa University with protocol number 096/24/ortho. Confidentiality was maintained when handling each case. Name of patient was not shared with anyone outside the research team and the information was used for the research purpose only. There is no conflict of interest nor incentive taken or force to do this research proposal.

4.12 Dissemination of Results

The findings of the study was submitted in both hard and soft copy to the department of orthopedics and trauma surgery, presented in front of the audience as requirement for subspeciality training in Orthopedic trauma surgery at Department of Orthopedics and Trauma Surgery, TASH. Through publication the research result will reach other concerned and interested bodies.

5. Result

5.1 Socio-demographic characteristics of the study participants

A total of 127 patients were found to full fill the inclusion criteria of this study and included. Among 127 participants 83 patients were male and the remaining 44 patients were females. From the study participants about 32.3% were younger than 50 years at the time of injury, 15.7% were

between 51-60years,18.9% were between 61-70years and the remaining 33.1% of the study participants were older than 70years.The following table and bar chart shows sex and age distribution of the study participants.

Figure 1:-Sex distribution of study participants for whom CMN was done for an indication of Unstable Traumatic Inter-trochanteric fracture at TASH,AAU.

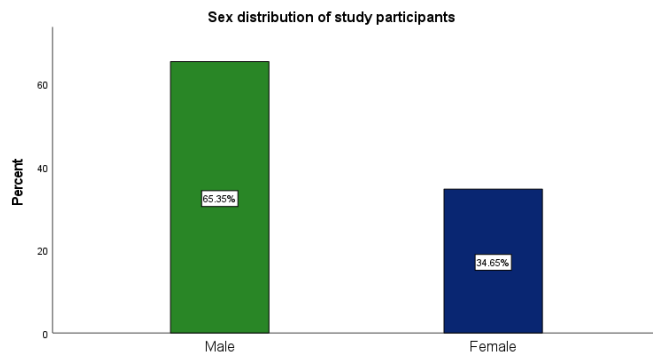
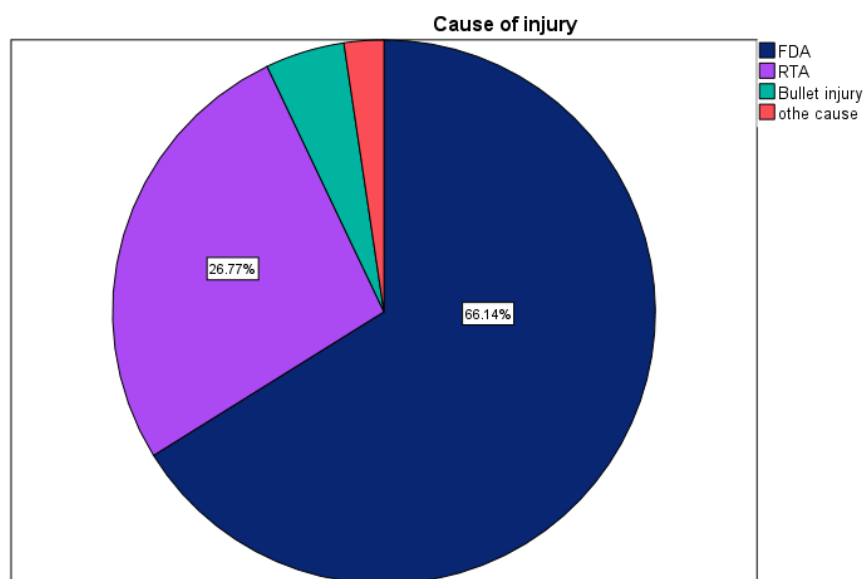


Table 1:-Age distribution of the patients with Unstable Traumatic Intertrochanteric fracture for whom Sharma Orthopedics CMN was done at TASH, Addis Ababa University.

		Frequency	Percent	Valid Percent	Cumulative Percent
	<=50years	41	32.3	32.3	32.3
	51-60years	20	15.7	15.7	48.0
	61-70years	24	18.9	18.9	66.9
	71-80years	30	23.6	23.6	90.6
	>=81years	12	9.4	9.4	100.0
	Total	127	100.0	100.0	

All the study Participants had Unstable traumatic Intertrochanteric Fracture. Falling down injury was the most common cause of proximal femur fracture in our study participants which accounts for about 66.1%, followed by road traffic injury which accounts for about 26.8%. Bullet injury and other causes were the cause of injury for the remaining 7.1% of the cases. The following Pie chart shows the cause of injury in our study participants.

Figure 2:-Causes of Unstable Traumatic Intertrochanteric fracture for whom CMN was done at TASH,Addis Ababa University



From the patients who were included in this study, 50.4% of them had right side hip injury. Among the study participants 85.8% of them had no other associated injury other than hip fractures. About 5.5% of the study participants had other associated lower extremity injury while about 7.1% of the patients had associated upper extremity injury. Only about 1.6% of the study participants had associated injury other than musculoskeletal system. The following table shows this finding.

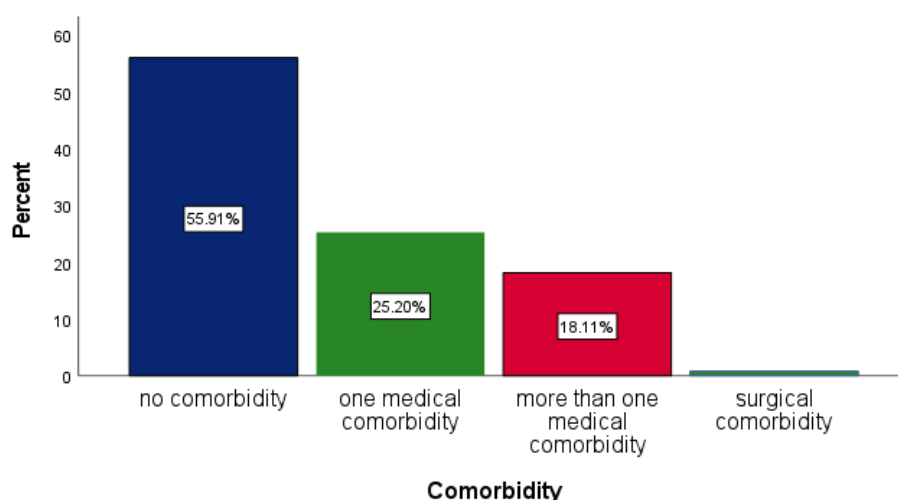
Table 2:-Injuries associated with Unstable traumatic Intertrochanteric fracture for whom CMN was done at TASH,AAU.

Associated injury

	Frequency	Percent	Valid Percent	Cumulative Percent
no associated injury	109	85.8	85.8	85.8
Lower extremity	7	5.5	5.5	91.3
Upper extremity	9	7.1	7.1	98.4
other system injury	2	1.6	1.6	100.0
Total	127	100.0	100.0	

Hip fracture commonly occurs in the senior population who had one or more preexisting comorbidity. In our study about 44.1% of the patients had one or more underlying comorbidity.

Figure 3:-The following figure shows presence and number of comorbidity present in patients with Unstable Traumatic Inter-trochanteric fracture treated with CMN at TASH, Addis Ababa University



Among our study participants only 11% got surgical treatment within first week of surgery, while about 34.6% of the participants were operated after 3weeks from trauma.61.4% of the study participants got treated with Short cephalo-medullary Nail(≤ 30 mm).Duration of surgery

varies significantly in our study participants. In about 19.69% of our patients surgery took more than 150minutes. In about 22.83% of our patients surgery is done within 90minutes. In about 51.97% of our study participants the estimated intra-operative blood loss ranges between 250ml to 500ml. In about 9.45% of our patients the estimated amount of intra-operative blood was more than 750ml.

Table 3:-Time elapsed from injury to surgical intervention in Unstable Traumatic IT fracture patients treated with CMN at TASH, AAU.

Time Elapsed from injury to surgery	Frequency	Percent	Valid Percent	Cumulative Percent
<=1week	14	11.0	11.0	11.0
1 to <=2weeks	38	29.9	29.9	40.9
2 to <=3weeks	31	24.4	24.4	65.4
>3weeks	44	34.6	34.6	100.0
Total	127	100.0	100.0	

Figure 4-the estimated amount of intra-operative blood loss as estimated by anesthesiologist during CMN done for Unstable traumatic IT fractures at TASH,AAU

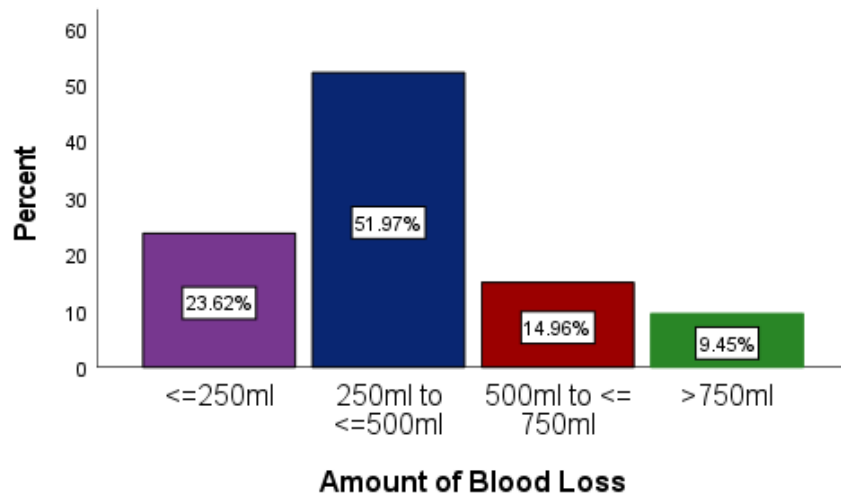
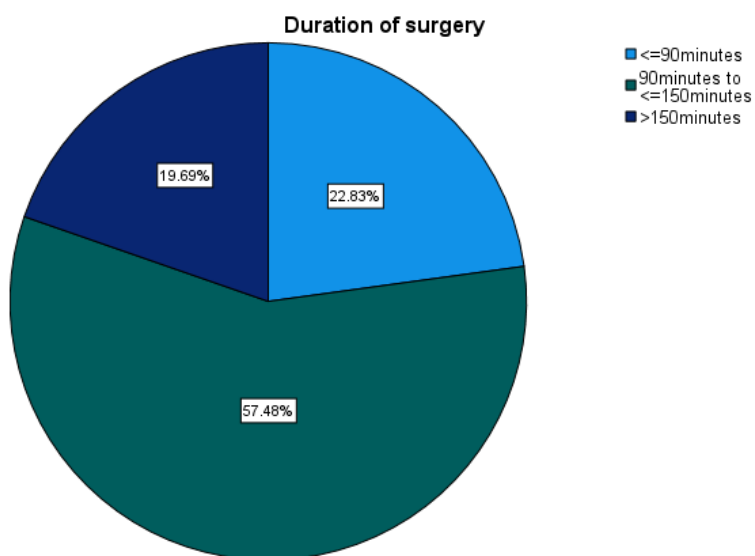


Figure 5:-The estimated time taken to do CMN for Unstable Traumatic Hip fractures at TASH,AAU



5.2-Patient reported Functional outcome, Radiologic union and associated complications

We accessed functional outcome of our study participants using Modified Harris hip score. From 127 study participants who full-filled the study criteria 23 participants died before 1year after surgery and were not available for the assessment of their functional outcome .So only 104 patients were interviewed using MHHS. Accordingly only 24% of the study participants had excellent functional outcome, while 28.8% of our patients available for assessment of functional outcome had good functional outcome.26% of the study participants claims they have poor functional outcome. All study participants had achieved radiologic union following CMN fixation for hip fractures and there is no case of radiologic nonunion.

The common complications found in our study participants following CMN fixation includes post op infection which occurred in 8.7% of the study participants, helical blade back out which was seen in 7.9% of the study participants and re-operation within first year of surgery was performed in 3.9% of study participants. We did not see complications like post op peri-implant fracture and helical blade cutout in our patients, but there were 3cases of intra-op fracture either new fracture in sub-trochanteric area or fracture propagation in to sub-trochanteric area.

Hip fracture is associated with significant morbidity and mortality. In our study we accessed one year mortality and we found it to be around 17.3%.

Table 4:-The following table shows patient reported functional outcome in 117 patients for whom CMN was done for Unstable Traumatic IT fracture at TASH,AAU as accessed by using MHHS.

Modified Harris Hip Score				
	Frequency	Percent	Valid Percent	Cumulative Percent
0-70	27	21.3	26.0	26.0

	70-79	22	17.3	21.2	47.1
	80-89	30	23.6	28.8	76.0
	90-100	25	19.7	24.0	100.0
	Total	104	81.9	100.0	
Missing	System	23	18.1		
Total		127	100.0		

Table 5:-The common complications seen in patients for whom Cephalomedullary nailing was done at TASH,AAU for an indication of Unstable Traumatic IT fractures.

	Frequency	percentage
Intra-Op complication	3	2.4
Post op infection	11	8.7
Helical blade back out	10	7.9
Helical blade cutout	0	0
Post op peri-implant fracture	0	0
Re-operation within 1 st year of surgery	5	3.9
Death within 1 st year of injury	22	17.3

5.3 Factors affecting functional outcome of study participants

In order to see the relation of independent variables on functional outcome of our study participants we did Chi-square test. We used a p-value of .05 to see significance of the

correlation. Accordingly we found age, presence of one or more comorbidity and helical blade back out had statistically significant correlation with patient reported functional outcome. Age has statistically significant correlation with functional outcome with P-value of <0.001, as the age of the patient increase the functional outcome tend to be poor, while the p-value for presence of one or more comorbidity and helical blade back out is .034 and .026 respectively. There is no statistically significant correlation between patient reported functional outcome and sex, associated injury, time elapsed from injury to surgery, duration of surgery, total duration of hospital stay, post op infection, and re-operation within the first year of initial surgery. The following table shows Chi square test between independent variables and functional outcome.

Table 6:-Chi square test to assess the correlation between independent variables and Patient reported functional outcome for patients for whom CMN was done for Unstable Traumatic IT fracture at TASH, AAU.

Independent variables	Chi square test				Modified Harris hip score
	Value	df	Sign(2-sided)	Strength of correlation(Cramer's V)	
Age	55.121	12	<0.001	0.42	
Sex	5.414	3	0.144	0.228	
Associated injury	10.75	9	0.293	0.186	
Comorbidity	13.605	6	0.034	0.256	
Time elapsed from injury to surgery	14.96	9	0.092	0.219	

Duration of surgery	3.323	6	0.767	0.126	
Total duration of hospital stay	9.86	9	0.361	0.178	
Post op infection	2.13	3	0.545	0.143	
Helical blade back out	9.245	2	0.026	0.298	
Re-operation within 1year	0.337	3	0.953	0.057	

Further two tailed pearson bi-variate correlation analysis was done to see if there is any correlation between length of CMN used and duration of surgery, as well as amount of blood loss. We found there statistically significant positive correlation between the length of CMN used and duration of surgery as well as estimated amount of blood loss. The following table shows this finding.

Table 7:-Pearson bi-variate correlation between length of CMN used and duration of surgery and amount of blood loss.

Independent variables	Bivariate correlation	Amount of blood loss
Length of CMN	Pearson correlation	.215
	Sig.(two-tailed)	.011
		Duration of surgery
Length of CMN	Pearson correlation	.276
	Sig.(two-tailed)	<.001

We found death as one of the commonest complication within first year after hip fracture. We tried to look for factors that increased the chance of death within 1year after hip fracture in our study participants and found older females with one or more comorbidity, longer duration of surgery and patients with more amount of blood loss were likely to die within first year of surgery. There is no statistically significant correlation between time elapsed from injury to surgery, presence of post-op infection, helical blade back-out, re-operation with in first year. The following table shows this finding.

Table 8:-Pearson bi-variate correlation between death within first year of hip fracture and independent variables in patients treated with cephalomedullary nail at TASH,AAU.

Independent variables	Bivariate correlation	Death with in 1 st year of initial surgery
Age	Pearson correlation	.368
	Sig.(two-tailed)	<u><.001</u>
Sex	Pearson correlation	-.248
	Sig.(two-tailed)	<u>.003</u>
Comorbidity	Pearson correlation	.523
	Sig.(two-tailed)	<u><.001</u>
Time elapsed from injury to surgery	Pearson correlation	.023
	Sig.(two-tailed)	.785
Duration of surgery	Pearson correlation	.277
	Sig.(two-tailed)	<u><.001</u>
Re-operation within 1 st year	Pearson correlation	-.094
	Sig.(two-tailed)	.270

Post op infection	Pearson correlation	.071
	Sig.(two-tailed)	.406
Amount of blood loss	Pearson correlation	.193
	Sig.(two-tailed)	<u>.022</u>
Helical blade backout	Pearson correlation	-.048
	Sig.(two-tailed)	.572

6.Discussion

The prevalence of hip fracture is increasing worldwide as the number of senior population is also increasing. Hip fracture commonly occurs in an elderly population following simple ground level fall. Hip fracture could be intra capsular or extra capsular; each accounting for about 50% of the cases.

The socio-demographic data in our study shows about 65.35% of the study participants were male and 52% of the study participants were older than 60years. We also found that right and left side were injured equally. Falling down accident (both ground level fall and fall from height) is the commonest cause of hip fracture in our study. According to the study done in Dehradun India in 2017 to know functional outcome of proximal femur fracture treated with cephalomedullary nail, about 67% of their study participants were older than 60years. This could be due to the longer life expectancy in their set up[20].

The radiologic union of hip fracture following cephalomedullary nailing in our study is 100%. In 2019 study done in Haryana India, to study functional and radiological outcome difference between DHS and CMN for fixation of inter-trochanteric fracture shows all patients achieved

radiologic union by 6months from surgery. This is similar to our finding[19].Another similar study done by Hoffman at Bochum Germany in 2019 entitled outcome of intramedullary nailing treatment for inter-trochanteric femoral fractures shows 6% nonunion rate. They attributed this rate of nonunion to active smokers and varus initial malreduction. The setup, patient populations and post-operative rehabilitation protocol was different from ours which probably contributed to this different finding[21].Deepak and his colleagues also did prospective study on functional outcome of proximal femur fracture treated with PFN in Maharashtra ,India from 2017-2019 and found 2.4% nonunion rate[25].

Hip fracture is a serious injury that could potentially result in significant morbidity and mortality. A systematic, timely and multi-disciplinary approach to this usually elderly group of patients significantly improve their outcome. In our study we used a modified Harris hip score to assess patient reported functional outcome at-least 1year after surgery is done for their hip fracture. We found 24% of our study participants had excellent functional outcome while 28.8% of the participants had good functional outcome. From the remaining participants 26% had poor outcome and the other 21.2% of the participants reported fair functional outcome. The study done by pranav kothiyal and his colleagues in 2017 at Dehradun to evaluate functional outcome of proximal femur fracture treated with cephalomedullary nailing shows less blood loss ,lesser operative time, less radiation expose, less amount of shortening, reduced hospital stay, less rate of infection and early mobilization. They used Oxford hip score and direct comparison with our study is difficult[20].

Another study done at Addis Ababa University,TASH,department of Orthopedics by Dr.Teshome Tena,entitled Comparison of Radiological and Clinical Outcome of Unstable Intertrochanteric Fracture Treated with Dynamic Condylar Screw and Proximal Femoral Nail Antirotation: A Facility Based Retrospective Study included 31 patients for whom CMN was done and found excellent MHHS in 64.5% of the patients,16.1% had good outcome, and the remaining 20% of the participants had fair and poor result. Although the study is done in the same setup with ours the difference could be due to difference in the sample size[26].

From 2017-2019 study was done in Maharashtra ,India to assess functional outcome of inter-trochanteric fracture treated with proximal femur nail. They prospectively followed 127 patients and assessed functional outcome of their patients at the end of 6months using physician based scoring system; Harris hip score. They found 29.1% had excellent outcome,48% had good outcome,13.4% had fair outcome and the remaining 9.5% had poor functional outcome. When compared to our study they achieved better functional outcome. This could be due to a lot of reasons like they do PFN for both stable(16%) and unstable (84%) intertrochanteric fractures and physician themselves assessed functional outcome rather than patient report[25].

The common complications in our study include post op infection, Helical blade back out and re-operations. This is very similar to what is reported by Deepak and his colleagues from Maharashtra, India (2017-2019) which includes infection, nonunion, delayed union, shortening and varus mal-reduction[25].

In our study factors that significantly affect functional outcome of our patients include age of patients, presence of one or more comorbidity and helical blade back out. In our study participants length of CMN used had significantly positive correlation with duration of surgery and amount of intra-operative blood loss. A systematic review done by John Dunn and his friends in 2015 at William Beaumont army medical center, USA on long versus short cephalomedullary nail for trochanteric femur fracture shows that short CMN was significantly associated with shorter operative time and decreased amount of intra-operative blood loss. This is similar with our finding.

7-Strength and Limitation of the study

This study is done for the first time in our set up and country as well. We used an internationally recognized patient reported functional outcome assessment tool, Modified Harris hip score which helped us to compare functional outcome of our patients with studies done elsewhere. We also tried to assess factors contributing to poor functional outcome of our patients. We also identified common complications that occurs in cephalomedullary nailing of hip fractures at TASH,AAU.

This study also had its limitations like being retrospective and single center. The sample size of this study was also small. Some of the patients were followed for only short period of time which

is 1year.We did not know the pre-injury functional status of our study participants; which may contributed to poor post op functional outcome.

8-Conclusion and Recommendations

8.1-Conclusion

It can be concluded from this study that significant number of patients for whom cephalomedullary nail was done at TASH, AAU had poor and fair functional outcome. Older age with one or more comorbidity and helical blade back out were the factors contributed to this outcome. Longer cephalomedullary nails were associated with more amount of intra-operative blood loss and longer duration of surgery. All patients treated with cephalo-medullary nail had achieved radiologic union within 1year period.

According to our study older females with one or more comorbidity, in which the duration of surgery lasts longer and those who loss significant amount of blood intra-operatively were more likely to die within 1year after hip fractures.

The commonest complications associated with cephalomedullary nailing for unstable traumatic IT fracture done at Tikur Anbessa specialized hospital, Addis Ababa University includes Post op infection, helical blade back out and re-operations within first year of surgery.

8.2-Recommendations

Based on the outcome of this study we recommend the following points

- ✓ We need multidisciplinary team to optimize the medical condition of elderly patients with hip fracture.
- ✓ The surgeon should operate on patients with hip fracture as soon as their medical condition is optimized in order to improve their functional outcome
- ✓ Shorter Sharma orthopedics cephalomedullary nails were equally effective with less complication for treatment of unstable Inter-trochanteric fracture when compared with long CMN.
- ✓ The duration of surgery should be shortened as much as possible
- ✓ Older patients with hip injury should be operated as soon as possible

- ✓ Sharma Orthopedics company should consider away to control back out of helical blade in the nail
- ✓ We need to consider cement augmentation in very osteoporotic patients in which helical blade back out is very likely.
- ✓ The hospital should strength the electronic patient data documentation
- ✓ we need to start to have national hip fracture registry
- ✓ The hospital should consider a way to trace patients who were lost from follow up like phone follow up,especially in elderly patients
- ✓ Fall prevention strategy should be advocated and thought ,especially among the elderly
- ✓ Patients with hip injury should be referred urgently to the center where surgical intervention is available for this type of injury.

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