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Knee Pains after Retrograde Intramedullary Nailing With Surgical Implant Generation Network Of Femur Fractures in Tibebeghon and Felegehiwot Referral Hospitals: two Year Retrospective Study

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**BAHIR DAR UNIVERSITY COLLEGE OF MEDICINE AND HEALTH
SCIENCES GRADUATE STUDY**

**KNEE PAINS AFTER RETROGRADE INTRAMEDULLARY NAILING WITH
SURGICAL IMPLANT GENERATION NETWORK OF FEMUR FRACTURES
IN TIBEBEGHON AND FELEGEHIWOT REFERRAL HOSPITALS: TWO
YEAR RETROSPECTIVE STUDY**

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**A RESEARCH THESIS TO BE SUBMITTED TO DEPARTMENT OF ORTHOPEDIC AND
TRAUMA SURGERY, COLLEGE OF MEDICINE AND HEALTH SCIENCES, BAHIR DAR
UNIVERSITY, FOR THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
SPECIALTY IN ORTHOPEDICS AND TRAUMA SURGERY**

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BAHIR DAR, ETHIOPIA

BAHIRDAR UNIVERSITY COLLEGE OF MEDICINE AND HEALTH
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Study	Study design	Retrospective cross sectional study
	Study project	Knee pain after retrograde intramedullary SIGN nail
	Study area	TGSH and FSHH department of orthopedic surgery, Bahirdar, Ethiopia

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Acronyms and abbreviations

AKP.....	anterior knee pain
AOR.....	adjusted odds ratio
BDU	Bahirdar University
COR.....	crude odds ratio
FCSH:	feleghiwot comprehensive specialized hospital
G.C.....	Gregorian calendar
DM.....	diabetic militias
HIV:	human immune deficiency virus
HTN.....	hypertension
IRB.....	Institutional Review Board
IM.....	Intramedullary nail
LMIC.....	low and middle income countries
PI.....	Principal Investigator
SIGN.....	surgical implant generation network
SOSD.....	SIGN online surgical database
SPS.....	Statistical Package for the Social Sciences
TGSH.....	Tibebeghon specialized hospital
WHO.....	world health organization

ABSTRACT

Background: Every year a lot of people are injured due to road traffic accidents. The majority of these injuries include long bone fractures, and the best treatment for these injuries is the surgical fixation with an intramedullary nail. Several complications have been described after intramedullary nailing of long bone fracture. However, one of the most common problems associated with tibia primarily, and retrograde femoral nailing secondarily, is chronic anterior knee pain.

Objectives: To estimate the incidence and identify factors associated with knee pain intramedullary nailing for femur fracture in patients operated with a SIGN nail in TGSH& FHSB, Bahirdar, Amhara Region, Ethiopia February 1, 2020 to January 31, 2022.

Methodology: Hospital based retrospective study was conducted on 110 patients who were admitted and operated with retrograde SIGN nail in TGSH& FHSB from February 1, 2020 to January 31, 2022 G.C who fulfill the inclusion criteria. Standardized format and tool was used to fill information from SIGN database, patients chart and patient phone interview. The collected data was entered into Epi Info version 7.2 and analyzed with SPSS version 26.0. Binary logistic regression model was used to analyze the association between variables. Finally tables, charts, graphs and other methods like percentile used to present and appraise results.

Result: The overall occurrence of knee pains after retrograde SIGN nail is 36.4%. Severity and prevalence varies with fracture sites, screw penetration of medial cortex, time from injury to definitive surgery. Distal third Fracture [AOR=2.74, 95% CI (1.100-6.826)], Prominent screw [OR=8.089, 95%CI (2.698-24.258)], Knee physiotherapy [OR= 0.395%CI (0.150-0.964)] were significantly associated with knee pain.

Conclusion and Recommendation: Overall incidence of knee pain after retrograde SIGN nail for femur fracture was comparable to other similar studies. Distal third fracture, interlocking screws longer than the bone diameter and post-operative physiotherapy were factors significantly associated to post-operative knee pain after retrograde nail for femur fracture. Using properly measured screws and physiotherapy are highly recommended.

1. INTRODUCTION

1.1 Background

Injury is defined as the physical damage resulting from exposure to sudden energy that exceeds the threshold limit of human physiological tolerance (1). Around 5.8 million people die annually as a result of injuries. Over 90 % of these fatal injuries occur in low- and middle-income countries (LMIC) like Ethiopia. In young people between the ages of 10 and 24 years around 97 % of deaths occur in LMIC, over 40 % of deaths are related to injuries, and road traffic injuries are the most common cause followed by a fall down accidents. Nowadays the global burden of injuries is increasing rapidly, and is almost entirely in LMICs. By 2030 the World Health Organization (WHO) expects road traffic accidents to be increased from the 9th to the 5th leading cause of all deaths worldwide(2). Many of these injuries require surgical care which may not be available to patients in many developing countries where it is the leading cause of death between 5 and 45 years age group.

Femoral shaft fractures are among the most common fractures encountered in orthopedic practice and can be the cause of prolonged morbidity and extensive disability unless treatment is appropriate. These fractures can be life threatening from an open wound, fat embolism, adult respiratory distress syndrome, or resultant multiple organ failure. Even with survival of the initial trauma, many patients suffer major physical impairment as a result of these fractures(3). Open wounds occur less frequently with femoral shaft fractures than with tibial fractures. Intramedullary nail is the best treatment for a long bone open and closed diaphyseal fracture (4,5).

An intramedullary nail is a metal nail that is surgically inserted into the fractured long bone to straighten and hold fractures so that they can properly heal in their near original anatomic alignment(6). The SIGN Nail is an intramedullary nail that is held in place by interlocking screws, 9° bend proximally, 1-1/2° bend in distal end for easier insertion. The SIGN Fin Nail does not require interlocking screws at the distal end, which makes surgery simpler and significantly faster(7).

Low- and middle-income countries use a locked type intramedullary nailing donated by SIGN Fracture Care International, a non-profit organization based in Washington State, Richland, USA, founded by Dr. Lewis G. Zirkle, Jr. in 1999. He has provided with training and SIGN

equipment which do not require image intensifier and a fracture table unlike nails used in the developed world(8).

Insertion techniques for intramedullary nailing of femur fracture are either ante-grade or retrograde .Retrograde nailing become more popular recently. Indications for this technique include the ipsilateral femoral neck, acetabula, tibia fractures, bilateral femur fractures, pregnancy, and morbidly obese individuals. The starting point in this approach is in the middle of the intercondylar notch and 2 to 4 mm anterior to the distal tip of Blumensaat's line(9).

However intramedullary nailing is standard of long bone management, it's associated with complication. A common complaint of retrograde nailing is knee pain, while for antero-grade nailing, it is hip pain and stiffness(10).Its etiology is unclear, but a multi-factorial origin has been suggested like damage to the meniscus or cartilage of the tibia plateau, injury to the infra patellar branch of the saphenous nerve, splitting and repeated injury to the patellar tendon per operatively and nail protrusion at distal end are some of proposed etiologies of anterior knee pain(11).

1.2 Statement of the problem

Several complications have been described after intramedullary nailing after long bone fracture. However, one of the most common problems associated with tibial primarily, and retrograde femoral nailing secondarily, is chronic anterior knee pain. This can be an important handicap for the patient, affecting his employment and daily or leisure activities. It is a serious and disabling complication once occurred with high associated morbidity. It causes delayed fracture healing, joint stiffness, osteoporosis, muscle atrophy. It also contributes to prolonged recovery, increasing costs to both patients and the health care provider and society(12).Its incidence has been reported to be as high as 86%. It may be present even in patients who have an intact knee as with antegrade femoral nailing(13,14)

A comprehensive review with pooled data from publications postoperative knee pain may occur in approximately 47 % of patients following intramedullary nailing(15).A patient's capacity to resume daily life and athletic activity is also a common question for surgeons. Patients commonly have significant restrictions to daily activity, Limitations in quality of life and limitations during sports activity(15)(16).

The exact etiology of anterior knee pain following tibia and retrograde femur nailing is not fully understood(17). Unless the factors associated to knee pain after SIGN intramedullary are not known it will continue one of the major problems for both the surgeon and the patient. It has tremendous effect to the patient in economic and social aspects.

There are only some researches done to address these issues and most studies identify different incidence of knee pain. There is no clear and specific reason for the pain and knee pain considered as multifactorial. There is no study in developing world including Ethiopia even if the problem is significant.

1.3 Significance of the study

Knee pain after intramedullary nailing of long bone fractures with SIGN implant is a common problem in set up causing significant morbidity, delayed rehabilitation and return to daily activity. Even though the burden is high there is no study which shows the incidence, associated factors contributing to it as well as prevention and treatment guidelines. This study will identify the incidence and major associated factors contributing to the development of the problem, will suggest preventive measures and will create awareness of health professionals and policy makers about the magnitude of the problem and associated morbidity. We consider it is important to do research in our hospital to inform SIGN Company, policy makers and multilateral donors in the university and the country at large to impact on the problems related to the implant. This will be the first study to be done in our university hospital with this title and will be used as a baseline for other future studies.

2. Literature review

Knee pain is the most common complication following intramedullary nailing of the tibia and retrograde femur, with an incidence reported to vary from 49-69%, particularly in young and active patients(18,19). E. Katsoulis et al. studied the incidence and etiology of anterior knee pain after ante grade and retrograde intramedullary nailing of the femur. In this group, there were five retrospective studies, seven prospective studies, two case studies, and one systematic review of the literature giving a total of 516 fractures. The mean follow-up was 15.9 months. The mean incidence of knee pain was 25.6% (1.1% to 55%) at the end of the follow-up. The results showed

that the mean incidence of knee pain was 25.6% (1.1% to 55%) in case of retrograde femoral nailing at the end of the follow-up(20).

Retrograde intramedullary nailing appears to be a reliable treatment option, mainly for distal femoral fractures. However, in the management of diaphyseal fractures, retrograde intramedullary nailing is associated with high rates of knee pain and lower rates of fracture union. In a systematic review of the literature reviewing 49 papers with a total of 963 fractures retrograde femur nailing was done, 50 patients (16.5%) with distal femoral fractures complained of knee pain during and Patients with femoral shaft fractures Knee pain was present in 83 (24.5%). 24 patients experienced pain due to distal screw prominence or impingement of the iliotibial band, nine due to secondary nail protrusion in the articular surface and five due to the development of post-traumatic osteoarthritis The causes of the pain were screw or nail, related problems in six patients, patellofemoral arthritis in eight patients, and reflex sympathetic dystrophy in one patient. The origin of the pain was unknown in 67 patients (21).

In prospective study to correlate the incidence of AKP to the type of approach used. In the RFN group of 222 fractures, 163 used the paratendinous approach (PTA) and 59 the transtendinous approach (TTA). RFN group the incidence of pain was significantly higher with the PTA, which increases the risk of pain compared with the TTA. However, in the tibia nailing group there was no statistical difference between the approaches with respect to pain(13)(22).

Prominent screw and its distance from the joint line is also contributes to AKP. But the amount of screw prominence that can be tolerated before becoming symptomatic is unknown. There may be a certain threshold to which screws that extend beyond the medial cortex are well tolerated. Hamaker et al showed that screws extending to or beyond the medial cortex were likely to be symptomatic. Screws within 40-mm from the joint line were more symptomatic(23).

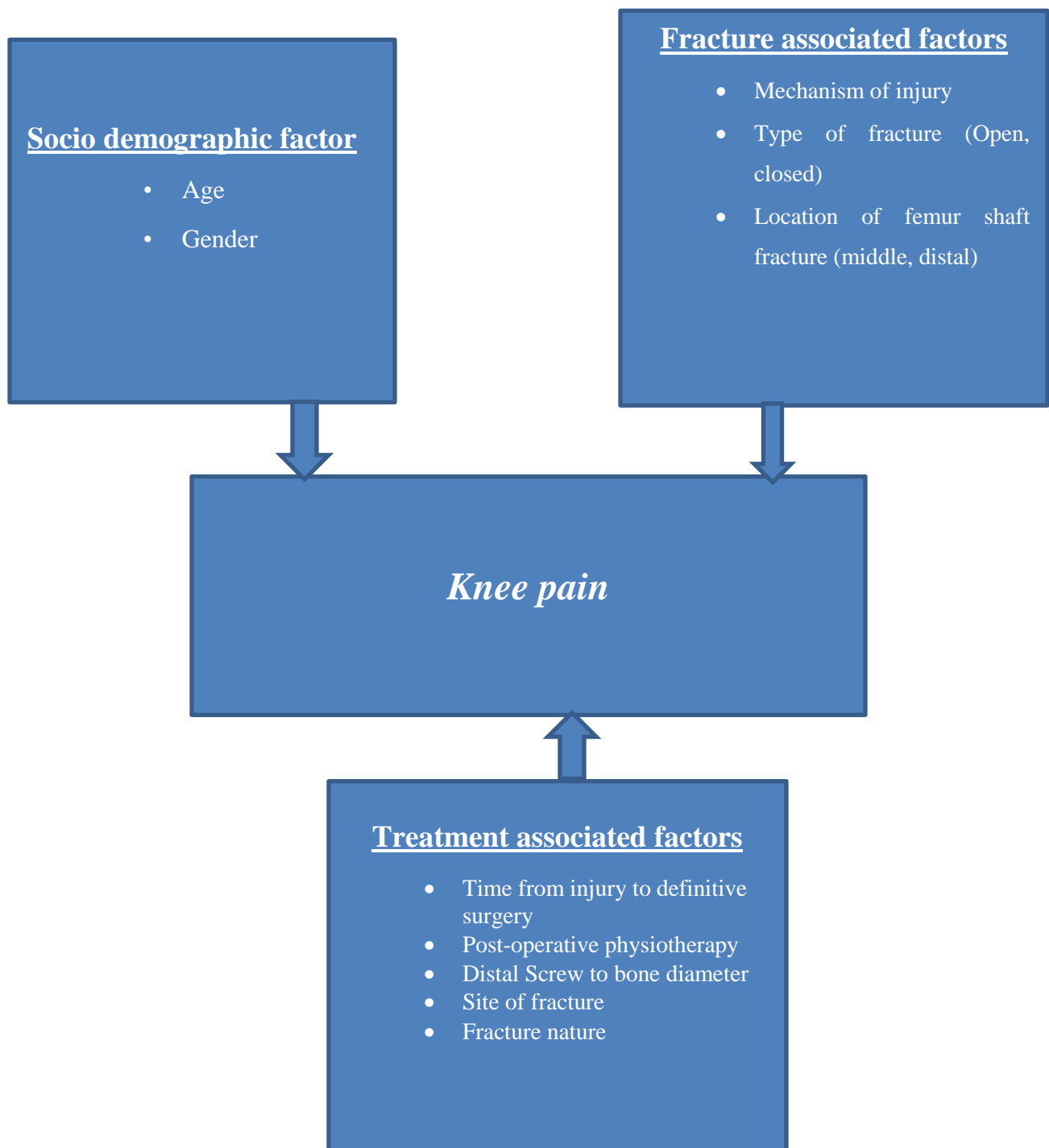
Pain may also be as a result of a nail protruding from its entry point in the intercondylar notch. This factor is directly under the control of surgeon and has been reported to occur in 4.4% of cases.in a cadaveric study A total of 15 cadaveric lower limbs preserved. Structures to become in contact with the tip of nail with 10 and 5mm nail prodding examined. With the nail 10 mm proud, the distal pole of the patella came into contact with the anterior tip of the nail as the knee was flexed to 70 degree in all 15 cases. Further Forceful flexion was not .As the knee was brought into extension, the anterior tip of the nail impinged on the anterior horn of the medial

meniscus at 15 degree of flexion in 14 of the 15 cases. With the nail 5 mm proud, the distal pole of the patella came into contact with the anterior tip of the nail as the knee was flexed to 70 degree in all 15 cases. Further forceful flexion was possible. As the knee was brought into extension, the anterior tip of the nail came into contact with the anterior horn of the medial meniscus and the posterior rim of the nail left an imprint on the anterior aspect of the tibial insertion of the ACL, in full extension in seven cases. In the remaining eight cases, only the anterior aspect of the tibial insertion of the ACL came into direct contact with the posterior rim of the nail in full extension. The tip of the nail must be at the level or deep to the radiographic landmark for the floor of the trochlear groove and the anterior tip of Blumensaat's line(24).

Associated knee soft tissue injuries may be one source of postoperative knee pain in otherwise asymptomatic patients. In a prospective cohort study of twenty-five patients with twenty seven knees sustained femur shaft fracture were examined clinically and with an MRI. Five ACL and two PCL injuries were discovered (19 percent and 7 percent, respectively). Four complete (Grade 3) medial meniscus tears (15 percent) and seven complete lateral meniscus tears (26 percent) were identified by postoperative MRI studies. The medial collateral ligament was injured in eleven knees (41 percent), with five (19 percent) identified as complete (Grade 3) injuries. The lateral collateral ligament was also injured in eight knees (30 percent); in half (15 percent) the injury was complete. Bone contusions were noted in eight (30 percent)(25) .

Injury of infra patellar branch of saphenous nerve, cutaneous nerve branches about the knee contributes to knee pain. In the 1990s, many authors published cadaver studies in which they charted the path of the infrapatellar branch of the saphenous (IPBS) nerve. The authors of two studies found the nerve near the medial joint line, running toward the tibia tubercle and crossing over the patellar tendon(17,26).

Figure 1: conceptual framework of independent and dependent variables for associated factor of knee pain



1.4 Objectives

1.4.1 General objective

To assess prevalence and factors associated with Knee pain after intramedullary nailing with surgical implant generation network of femur fractures undergo retrograde nail from November 1, 2020GC to October 31, 2022GC at Tibebeghon and feleghiwot Referral Hospital, Bahirdar, Ethiopia.

1.4.2 Specific objective

To assess Incidence of Knee pain after retrograde IMN with SIGN nail for femur fractures.

To identify factors associated with Knee pain after retrograde IMN with SIGN nail for femur fractures

3. METHODS AND MATERIALS

3.1 Study area

This study was conducted at TGSH&FHH. TGSH is one of the biggest specialized university hospitals in Amhara region and in the country at large. It was established in 2011 E.C /2018 G.C which landed in an area of 10000sqM. Currently, the hospital is delivering different clinical services to the region. The hospital has more than 500 beds in all its wards and over 67 beds in orthopedics and trauma surgery ward. Operations were done 5 days in a week as elective case and all days of the week emergency cases. The department had its own major operation room with two operating tables. The hospital had a separate SIGN follow up clinic which is used to follow SIGN patients, report the surgeries. The study was conducted on SIGN patients in SIGN clinics by reviewing charts from the hospital record rooms, patient phone interview and online database records from SOSD.

3.2 Study Design& period

Retrospective cross sectional study design was conducted on patents with femur fracture admitted to TGSH&FHRH treated with retrograde SIGN nail from July 15, 2022 to July 30, 2022 GC.

3.3 Source population

All Patients had been admitted to TGSH & FHH Orthopedic surgery department with the diagnosis of long bone fractures and operated with SIGN intramedullary nail from February 1, 2020 to January 31, 2022 at TGSH& FHH, Bahirdar, and Amhara Region, Ethiopia.

3.4 Study population

Selected Patients had been operated for femur fractures with retrograde SIGN nail from February 1, 2020 to January 31, 2022 at TGSH& FHH, Bahirdar, Amhara Region, Ethiopia.

3.5 Inclusion criteria

All Patients with femur fracture who undergo retrograde SIGN nailing and whose chart and SOSD was complete during study period.

3.6 Exclusion criteria

- Patients with incomplete SIGN database online documentation
- Patients who has been lost from follow up not accessible with phone call
- Ipsilateral patellar and/tibia fracture are excluded from the study

3.7 Sample size

The sample size was calculated using Epi info 7 software versions with the population survey feature and with the assumption of 95% confidence interval (CI) & 37.6% expected frequency from retrospective cross sectional study carried out in Kenya from 2007 to 2009. The population size from SOSD on the study period was 170, which gave a sample size of 116 and to increase the yield, and decrease errors all cases who were fulfill the inclusion criteria which are 110 were studied.

3.8 Data collection and quality control

3.8.1 Techniques of Data collection and Procedures

Data collection tools, record checklists adopted from different literatures and patient's medical record and organized according to the study objectives. Online SIGN database, patients charts were reviewed to collect patient's medical records and phone number. Patients were interviewed with phone call. Data was recorded using structured checklist from patient chart, phone interview & SIGN online database. Collected data entered into Epi-Info version 7.2 with giving each case a unique code then imported to the Statistical Package for Social Science (SPSS) version 26 and analyzed.

3.10.2 Data quality management/quality control

Two data collector were trained about collecting materials and on how to fill the checklists on EPI info. Data was collected from June 15 to June 30/ 2022GC by the trained data collectors. Close supervision was carried out during data collection period by principal investigator.

3.11 Data Processing and Analysis:

Collected data entered in to Epi-Info version 7.2 then imported to the Statistical Package for Social Science (SPSS) version 26 and analyzed. To describe the study population,

Descriptive statistics like Frequency, percentage and, cross tabulation were used to describe the variables. Binary logistic regression was used to assess the influence of independent factors on the dependent variable. The final association was presented using Adjusted Odds ratio (AOR) with 95 % confidence interval (CI) and P value < 0.05 level of significance as cut of point. Graphs, charts and tables were used for data presentation and dissemination.

3.12 Study variables

3.12.1 Dependent variables:

- Knee pain after SIGN nail

3.12.2 Independent variables

- Age
- Sex
- Occupation
- Educational status
- Mechanism of injury
- Location of fracture
- Type of fracture
- Associated injury
- Previous knee pain
- Pattern of fracture
- Chronic medical illness
- Temporizing external fixation
- Surgical approach
- Duration from injury to definitive treatment

3.13 Operational Definitions

- Screw prominence: screw length greater than bone diameter and within 40 mm from the joint line(23)
- Proper knee physiotherapy: ROM and quadriceps strengthening exercise guided by physiotherapist

- Nail protrusion: The distance between the tip of the nail anteriorly and most proximal part of the trochlear articular surface (24)

3.14 Ethical clearance

Ethical clearance was obtained from the Ethical review board of Bahirdar University .Communication with the different official administrators was made through formal letter obtained from Bahirdar University. After the purpose and objective of the study had been informed, verbal consent was obtained from each study participants. The information collected for this research will be kept confidential and information collected by this study will stored in a file, without participant name, but a code number assigned to it. Participants were also informed that participation will be on voluntary basis and they can stop or leave the participation at any time if they will not comfortable about the phone interview and this would not affect them from getting any kind of health service.

4. RESULT

From a total of 170 femur fracture patients admitted and operated with retrograde intramedullary Nail between February1, 2020 to January 31, 2022 C in TGSH&FHRH, bahirdar110 patients were studied. 60 of the patients are not included to the study because of incomplete SOSD; phone number was not registered, not responding their phone call.

Socio demographic characteristics

The ages of the study population ranged between 17 to 75 years with a mean age of 31.74 years. Most injuries affect the young age group. The fractures were predominantly occurred in males, giving M: F ratio of 3.8:1. Most of the patients sustained femur fracture was farmers. On average, the duration between injury and nailing was 19.89+12.1 days, with a range of 1 to 64 days. The average follow-up (time of surgery to study) is 14 months. All fractures reduced and reamed manually. The fractures were either in the middle third (60.9%) or lower (30.1%) of the femoral shaft.

Table 1 Distribution of potential patient related characteristics in retrograde femur SIGN patients, TGSH& FHSB, Bahirdar, Amhara Region , Ethiopia, February 1, 2020 to January 31, 2022 (N=110)

Variables	Category	Frequency	Percentage %
Sex	Female	23	20.9
	Male	87	79.1
Age	15-55 years	102	92.7
	>55	8	7.3
Occupation	Farmer	49	44.5
	Students	11	10.0

	Government employee	10	9.1
	Soldiers	23	20.9
	Merchant	4	3.6
	Drive	11	10.0

Injury related characteristics

Majority of the Femur shaft fractures treated with retrograde SIGN nail were closed 50.9% (N=56). Most of these injuries were caused by road traffic accidents 54 % (N=49.1) and mainly affects middle third 60% (N=66) followed by distal third 35.5% (N=39).

Table 2:frequency distribution of injury related factor of study participant, TGSH&FSSH, Bahir dar, Amhara Region , Ethiopia, February 1, 2020 to January 31, 2022 (N=110)

Variables	category	Frequency	Percent%
Trauma Mechanism	RTA	54	49.1
	gun shot	43	39.1
	Fall & other	12	11.8
Nature of fracture	Closed	56	50.9

	GA1	4	3.6
	GA2	6	5.5
	GA3A	44	40.0
Fracture location	Middle third	67	60.9
	Distal third	43	39.1

Treatment related characteristics

Average interval between injury and definitive surgery was 9.84 ± 12.146 days. Concerning nail entry 51.8% (N=57) femoral nails were inserted through medial parapatellar, 16.4 % (N=18) lateral Parapatellar and 31.8 % (N=35) patellar tendon splitting. 54 % (N=60) patients don't have post-operative physiotherapy.

Table 3: frequency distribution of treatment related characteristics of study participant, TGSH&FHSB, Bahir dar, Amhara Region , Ethiopia, February 1, 2020 to January 31, 2022 (N=110)

Variable	Category	Percent
Time Interval between fracture and Fixation (days)	Mean \pm SD	9.84 \pm 12.146
	Median(min;max)	5(1;64)

	< 15	76.4%(N=84)
	>15	23.6 %(N=26)
Surgical approach (nail entry)	medial Para patellar	51.8%(N=57)
	patellar tendon split	31.8%(N=35)
	lateral Para patellar	16.4%(N=18)
Post-operative physiotherapy	Yes	45.6%(N=50)
	No	54,4%(N=60)
Screw penetrate medial cortex	Yes	21.8%(N=24)
	No	78.2%(N=86)

Occurrence and severity of knee pain after retrograde Femur SIGN intramedullary nail

In a 2 year study, a total of 40 cases of knee pains were observed with an incidence of 36.4%. Severity and prevalence varies with post-operative physiotherapy. Patients that don't have post-operative physiotherapy 72.5 %(N=29) affected more than those had post-operative physiotherapy 27.5 %(N=11). Most of the patients complain pain while walking up/down stair (26%), squatting (25.2%) and after long distance walking. Most of the patients have mild to moderate pain which doesn't affect their daily activity and 6.4 %(N=7) of patients requires analgesics.

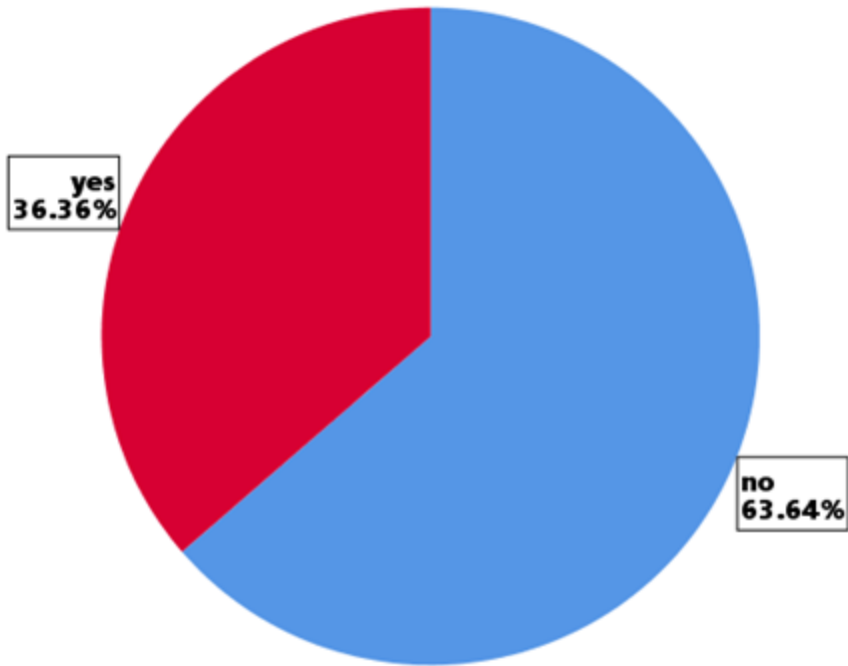


Figure 2: pie chart showing prevalence of knee pain in study participant, TGSH&FHH, Bahirdar, Amhara Region, Ethiopia, February 1, 2020 to January 31, 2022 (N=110)

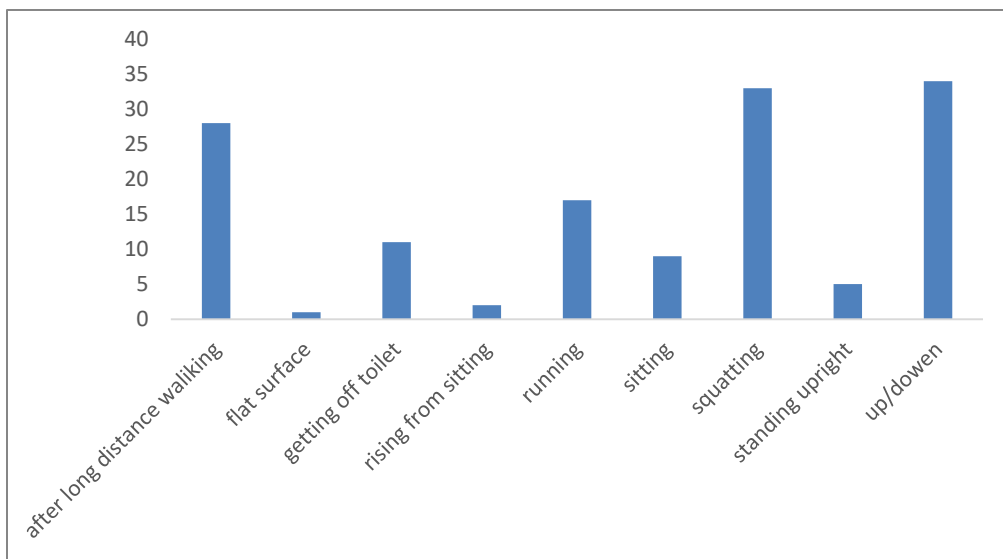


Figure 3: bar chart showing different positions patients notice the pain, TGSH&FHH, Bahirdar, Amhara Region, Ethiopia, February 1, 2020 to January 31, 2022 (N=40)

Table 4: Summary of occurrence of knee pain with different associated factors, TGSH&FSSH, Bahirdar, Amhara Region, Ethiopia, February 1, 2020 to January 31, 2022 (N=110)

Variable	Category	Knee pain	
		Number (out of 40)	Percent (%)
Gender	female	10	25.00%
	Male	30	75.00%
Age of patient	15 - 55	35	87.5%
	>55	5	12.5%
Type of nail	standard nail	23	57.50%
	fin nail	17	42.50%
screw to medial cortex	No	22	55.00%
	Yes	18	45.00%
Injury –nailing	< 15	25	62.50%
	>15	15	37.00%
fracture sites	middle shaft	19	47.50%
	distal shaft	21	52.50%
Injury mechanism	RTA	18	45.00%
	gun shot	18	45.00%
	fall,fall&other	4	10.00%

knee physiotherapy	No	29	72.50%
	Yes	11	27.50%
pattern on x-ray	Simple	21	52.50%
	Wedge	2	5.00%
	Comminuted	17	42.50%
fracture nature	Closed	17	42.50%
	GA1	2	5.00%
	GA2	2	5.00%
	GA3A	19	47.50%
Duration from fixation in months	6-12	22	55.00%
	13-18	7	17.50%
	19-24	11	27.50%

Association between Potential Associated Factors and the Occurrence of knee pain

Predictors for the occurrence knee pain were assessed using bi variable and multi variable Binary logistic regression analysis to identify competent variables and assess presence or absence of association between the dependent and independent variables.

Variables which have p value <0.25 were selected from results of bivariate binary logistic regression analysis and entered to multi variable binary logistic regression analysis model.

Table 5:Bi-Variable Binary Logistic Regression Analysis of factors related with knee pain, TGSH, Bahirdar, Amhara Region, Ethiopia, February 1, 2020 to January 31, 2022 (N=110)

Variable	Category	Knee pain		p-value	COR (95% CI)
		yes	No		
Age of patient	15-55	35	67	0.127	3.190(0.720-14.136)
	>55	5	3	1	
screw to medial cortex	No	22	64	1	
	Yes	18	6	0.00	8.727(3.075-24.771)
Injury –nailing	<= 15	25	59		1
	>15	15	11	0.012	3.218(1.298-7.977)
fracture sites	middle third	19	48		1
	distal third	21	22	0.031	2.411(1.084-5.366)
knee physiotherapy	No	29	31		1
	Yes	11	39	0.005	0.302(0.130-0.698)
Surgical approach	Medial parapatellar	25	32	0.211	1
	Tendon split	9	26	0.083	0.443(0.176-1.113)
	lateral parapatellar	6	12	0.431	0.640(0.211-1.944)

In a multivariate binary logistic regression analysis model; post-operative knee physiotherapy, distal third femur fracture and prominent interlocking screws were found to be significantly associated with occurrence of knee pain with a p-value <0.05.

Table 6: multi-Variate Binary Logistic Regression Analysis of factors related with knee pain, TGSH&FHSB, Bahirdar, Amhara Region, Ethiopia, February 1, 2020 to January 31, 2022 (N=110)

Variable	Category	Knee pain		P- value	AOR (95%)
		No	Yes		
fracture sites	middle shaft	48	19		1
	distal shaft	22	21	0.030	2.74(1.100-6.826)
screw to medial cortex	No	64	22		1
	Yes	6	18	0.000	8.089(2.698-24.258)
Knee physiotherapy	No	31	29		1
	Yes	39	21	0.042	0.381(0.150-0.964)

5. DISCUSSION

In these study 110 patients recruited with mean age of the study group is 31.74years \pm 13.61years range from 17-75 years old and male to female ratio is 3.8:1. These demographics demonstrate that femoral shaft fractures were most common in males at their very productive age and it might have far reaching direct and indirect social economic effect within the society. In this study the overall occurrence of knee pain after femur fracture SIGN intramedullary nailing was 36.3%. This result was consistent with comparative cross sectional study carried out on patients who were treated with retrograde and antegrade intramedullary nailing for femoral shaft fractures between January 2007 and December 2009 in Kenya incidence of knee pain was 37.5% retrograde group (27). The Canadian Orthopedic Research Society and the Canadian Orthopedic Association study reported 30% frequency of nonspecific knee pain complaints persisting at almost three years after injury which was also consistent to our study.

E. Katsoulis et al. studied the incidence and etiology of anterior knee pain after ante grade and retrograde intramedullary nailing of the femur. The results showed that the mean incidence of knee pain was 25.6% (1.1% to 55%) in case of retrograde femoral nailing at the end of the follow-up(20). Incidence increased in our setup may be due to poor compliance to physiotherapy rehabilitation protocol in our patients as a result of lack of proximity to a physiotherapy center, high energy trauma and proximity fracture to the joint. A consecutive series of 23 patients with reamed retrograde femoral nails was reviewed by RE legone and found 55% of AKP(28).the incidence is low in our set up may be we uses 3rd generation nail.

Regarding to factors associated to knee pain after retrograde SIGN nail, screw longer than bone diameter had 8.7 times (AOR=8.727(3.075-24.771) more likely to develop knee pain than those used proper screw length. cases with post-operative proper physiotherapy were 70% less likely to have knee pain than those don't have proper physiotherapy (AOR=0.30, 95%CI:0.130-0.698). Those patients with distal third femur fracture had 2.411 times (AOR= 2.41, 95%CI 1.084-5.366) knee pain than patients with middle third fracture.

This study shows that prominent screw was one of the factors with strong association with knee pain after femur fracture treated with retrograde SIGN nail. Patients with prominent screw were 8 times more likely to develop knee pain than patents treated with proper screw length. a

retrospective review at a Level I trauma center done by Hamaker et al showed that Prominent screw and its distance from the joint line was contributing factor to AKP(OR, 1.18; 95% CI, 1.10– 1.27; $p < 0.0001$). This study had consistent result with our study and Notably pain related to prominent screw is justified by irritation of soft tissues envelop surrounding the lateral aspect of knee (23).

This study found distal femoral fracture as attributor of knee pain after retrograde femoral IMN fixation. Distal third femur fracture operated with retrograde SIGN nail 2.74 times more likely to develop knee pain than middle shaft fracture. Retrospective study on 31 patients who underwent retrograde femoral academic medical center in France shows there was no statistically significant relationship between knee pain and site of fracture. This study also shows no statistical significant relation between knee pain and other factor like age, sex, comminution and fracture nature. Hospital based cross sectional study in Kenya shows differences in the average functional scores for the different fracture levels treated with SIGN nail were not statistically significant(27,28). This significant association of this variable to knee pain in our study justified by poor compliance to physiotherapy in our patients and they use small sample size .

This study shows that those patients with post-operative physiotherapy have 62 % (AOR=0.38, 95%CI, 0.150-0.964) less likely to develop anterior knee pain. A comparative cross sectional study carried out on patients who were treated with retrograde and antegrade intramedullary nailing for femoral shaft fractures between January 2007 and December 2009 ,Kenya continuous passive motion functional training of the knee after nailing was one the significant determinants of outcome. Justified by joint will develop arthrofibrosis and weakening of surrounding knee soft tissue envelop(27).

6. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Overall incidence of knee pain was comparable to most similar studies. Distal third fracture, interlocking screws longer than the bone diameter and post-operative physiotherapy were factors significantly associated to post-operative knee pain after retrograde nail for femur fracture. There is no significant difference between fracture patterns, in regards to knee pain.

Recommendations

- ❖ For Tibebeghon Specialized Hospital & Feleghiwot referral hospital
 - More attention should be given to patients distal third femur fractures
 - Physiotherapy by physiotherapist
 - The length of the locking screws must be carefully checked to avoid protrusion and irritation of the soft tissues
- ❖ For Federal Ministry of Health and Regional Health Office
 - Measures to tackle road traffic accident and gunshot should get enough emphasis as these are the leading cause of femur fractures.
- ❖ For Researchers

It is a potential area to do further study, so we recommend researcher to conduct further prospective and multicentric study on measure of knee functional outcome with details of associated factors especially distal third fracture and post-operative rehabilitation.

Limitations & strength

- ✓ Being retrospective study
- ✓ Small sample size
- ✓ Difficulty to get the patients on phone call

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Declaration

I, the under signed, declared that this is my original work has never been presented in this or any other university, and that all the resources and materials used for the research thesis, have been fully acknowledged.

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