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Knee Stiffness Of Patellar Fractures And Associated Factors After Fixed With Tension Band Wiring In Pateints At Tibebe Ghion Specialized Hospitaland Felegehiwot Comprehensive Specialized Hospital, Bahir Dar, North West Ethiopia.

Sahal, Ahmed

BAHIR DAR UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF MEDICINE

DEPARTMENT OF ORTHOPAEDICS & TRAUMATOLOGY SURGERY

KNEE STIFFNESS OF PATELLAR FRACTURES AND ASSOCIATED FACTORS AFTER FIXED WITH TENSION BAND WIRING IN PATEINTS AT TIBEBE GHION SPECIALIZED HOSPITAL AND FELEGEHIWOT COMPREHENSIVE SPECIALIZED HOSPITAL, BAHIR DAR, NORTH WEST ETHIOPIA.

THESIS SUBMITTED TO DEPARTMENT OF ORTHOPEDICS AND TRAUMA SURGERY SCHOOL OF MEDICINE, COLLEGE OF MEDICINE AND HEALTH SCIENCES, BAHIR DAR UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR SPECIALTY IN ORTHOPEDICS AND TRAUMATOLOGY SURGERY.

BY: SAHAL AHMED (MD, ORTHOPEDICS AND TRAUMA SURGERY, FOURTH YEAR RESIDENT).

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	Name	**Address**
P. I	Sahal Ahmed (MD, Orthopedics &trauma Surgery, fourth year resident)	Email: Drsahal79@gnmail.com Cell phone: +251 935014177
Advisors	Misganaw Alemu; MD, Assistant Professor, Consultant of Orthopedic And Trauma Surgeon.	Email: Misgiealem@gmail.com Cell phone: +251902653870
	Yeshalem Mulugeta (PhD)	Email: Yeshalem_mulugeta@yahoo.com Cell phone: +251918783819
Study	Study design	Cross sectional study design.
	Study project	Assessment of knee stiffness of patellar fractures & associated factors after fixed with Tension Band Wiring "TBW".
	Study area	TGSH & FHCSH department of Orthopedics And Trauma Surgery, Bahir-Dar, Ethiopia.
	Study period	August-1-2019 to August-1-2022
	Total budget	25,223 ETB.

DECLARATION

This is to certify that the thesis entitled to assess knee stiffness of patellar fractures and associated factors after fixed with tension band wiring in patients in tibebe ghion specialized hospital and felege hiwot comprehensive specialized hospital, submitted in partial fulfillment of the requirements for the degree of specialty of orthopedic and trauma surgery in the Department of orthopedics Bahir Dar University, is a record of original work carried out by me and has never been submitted to this or any other institution to get any other degree or certificates. The assistance and help I received during the course of this investigation have been fully acknowledged.

Name of the candidate Date Place

_____ _____ _____

APPROVAL OF THESIS FOR DEFENSE

I hereby certify that I have supervised, read, and evaluated this thesis/dissertation titled To assess knee stiffness of patellar fractures and associated factors after fixed with tension band wiring in patients in TGSH and FHCSH by Dr Sahal Ahmed prepared under my guidance. I recommend the thesis/dissertation be submitted for oral defense.

Principal investigator (PI)

Name Dr Sahal Ahmed mohamud

Signature

Date 29-Sep-2023

Advisors

1. Name Dr. Yoshalem muligeta

Signature

Date 29-sep-2023

2. Name Dr. Tilahun Alemu

Signature

Date 29-Sep-2023

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ABBREVIATIONS AND ACRONYMS

ADLS	Activity of daily living scale
AO	Osteoarthritis
BDU	Bahir Dar University
PI	Principle investigator
CI	Confidence Interval
CW	Circumferential Wire
FDA	Falling down accident
FHCSH	Felege hiwot comprehensive specialized hospital
IRB	Institutional review boards
ICU	Intensive care unit
KKW	Kirschner (K)-wires
OPD	Outpatient department
RA	Rheumatoid arthritis
ROM	Range of motion
RTA	Road traffic accident
SPSS	Statistical package for the social sciences
SRI	Sport related injuries
TBW	Tension band wire
TGSH	Tibebe ghion specialized hospital
TKA	Total knee Arthroplasty
WRI	Work-related injuries

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ABSTRACT

Background: Fractures of the patella are one of the most common fractures encountered by an orthopedics and trauma centers. It is also difficult to restore the desired anatomical continuity and congruity of the articular surfaces after reduction and thereby causing complication like stiffness of the joint, prominent hardware, non-union, infections and OA. Surgical fixation is tension-band wiring technique. The aim of this study is to study the knee stiffness of patellar fractures and associated factors after fixed with tension band wiring.

Objectives: To assess knee stiffness of patellar fractures & associated factors after fixed with tension band wire in TGSH and FHCSH, from August-1-2019 to August-1-2022.

Methods: A cross-sectional study was used to conduct the study on patients of 243 samples that were admitted at TGSH and FHCSH and who get orthopedic surgical care from August-2019 to August-2022. The study populations were Patients admitting with a diagnosis of patellar fractures. Collected dated were recorded review in sheet. SPSS version 25.0 for analysis. Simple-multiple binary regression studies were used for detecting the associations between variables. P Value < 0.05 was used to determine the association of variables and or with 95% CI was used to determine the strength. Bi variated and multi variated analysis were used.

Result: In this study the magnitude of poor knee stiffness of patellar fractures after fixed with tension band wiring was found to be 11.5%. Follow up (AOR: 7.82, 95%CI: 1.770, 29.96), Time during arrival (AOR: 10.004, 95%CI: 1.10, 90.86), Age (AOR: 12.85, 95%CI: 1.144, 144.36), And Infection (AOR: 6.71, 95%CI: 1.653, 27.29) were the factors significantly associated with knee stiffness.

Conclusion: This study showed that the overall poor knee stiffness of patellar fractures after fixed with tension band wiring was low in this study area, lack of follow up, Time during arrival, patients aged between 61 up to 80 years and infection were factors significantly associated with poor knee stiffness of patellar fractures after fixed with tension band wiring.

Key word: Patella Fractures, tension band wiring, functional outcome, knee stiffness.

1 INTRODUCTION

1.1 Background

The commonest age group involved in patellar fractures at the fourth and fifth decade 66.66%. road traffic accident (RTA) and domestic injuries like falling down accidents (FDA) in the slippery ground were the major causes of fractures and the incidences were similar 44.44% [1].

Fractures of the patella are one of the most common fractures encountered by an orthopedic surgeon. They continue to pose vexing problems as this being intra-articular is subjected to continuous deforming forces from muscles. It is also difficult to restore the desired anatomical continuity and congruity of the articular surfaces after reduction and thereby causing complication like osteoarthritis {OA}, stiffness of joint, non-union [2].

Patella fractures are more common and account for approximately 1% of all fractures. the most common method of fixation is a modified tension band wiring by using 2 k wires through a midline longitudinal incision which has its own complications [3].

The patella is the largest sesamoid bone. The mechanical function of the patella is to hold the entire extensor` strap' away from the center of rotation of the knee, thereby lengthening the anterior lever arm and increasing the leverage and efficiency of the quadriceps [2].

It is also difficult to restore the desired anatomical continuity and congruity of the articular surfaces after reduction and thereby causing complications like osteoarthritis, stiffness of joint, non-union [2].

Surgical fixation is recommended for fractures that either disrupt the extensor mechanism or demonstrate >2 to 3 mm step-off and >1 to 4 mm of displacement. Anatomic reduction and fixation with a tension-band wiring technique is associated with the best outcomes; however, symptomatic hardware is a frequent complication. Open fractures are associated with more complications than closed fractures. These complications can be mitigated with timely debridement, irrigation, and internal fixation [4].

About 1/3 of patella fractures require surgery, which is indicated if there is damage to the extensor mechanism or in fractures associated with 2 mm step-off incongruity.

The objectives of surgical treatment include precise anatomic reduction of the articular surface by stable fixation, and restoration of the knee-extensor mechanism, thus allowing early mobilization. Various internal fixation techniques have been described like, circumferential wiring (CW), tension band wiring (TBW) and modified tension band wiring with K wire. The goal of treatment is to reestablish the continuity of extensor mechanism and to restore the normal function of knee [5].

Historically, the AO tension-band wiring (TBW) technique has been the most commonly used, and involves two parallel axial Kirschner (K)-wires (KKW) in association with a stainless steel wire placed anteriorly in a vertical figure-of-eight. However, post-operative symptoms and complications related to TBW are not rare. Currently, several fixation methods of patellar fractures are in use, including tension band wiring, cerclage wiring, and screw fixation [6,7].

Despite modified tension band wiring being most commonly performed surgery for patella fractures, there are few studies performed in our context. The activities of daily living in our country differ from that of the western world [7].

Various factors like age, bone quality and knee flexion angle at the time of injury also influences the fracture pattern apart from the mechanism of injury [4]. Symptomatic hardware due to subcutaneous location represents the most common complication ranging up to 60 % which might necessitate implant removal prematurely.

People have to squat, sit crossed legged and walk up and downhill more often others because of various terrains and cultural behavior. Despite these variations still believe that tension band wiring technique is equally good in our populations, because of the mechanical advantage of modified tension band wiring principle. So the aim of study was to evaluate the effectiveness of tension band wiring technique for the patella fractures in tibebe ghion specialized hospital [3].

1.2 Statements of the problem

Patellar bone fractures are a major widespread problem compared to the world and African countries. It is very much associated with injuries from road traffic accidents (RTA), fall down accidents (FDA), stick injuries, gunshots, sports injuries, and work-related injuries (WRI). According to the study done by C. Gwinner indicates that the injuries patellar fractures account for about 1% of all skeletal injuries and are most prevalent within the age group of 20–50 years. The incidence in men is twice as high as in women. Closed fractures of the patella represent the vast majority of this injury. However, up to 7% of the cases result in open fractures. Approximately 80% of open patellar fractures are associated with multiple accompanying injuries, namely fractures of the most frequent causes are Road traffic accidents in 78.3%, followed by work-related accidents in 13.7% and domestic accidents in 11.4%. Sports-related fractures of the patella are relatively seldom. However, acute dislocations of the patella are associated with osteochondral fractures of the patella or fractures of the lateral femoral condyle in up to 70% of cases femur or acetabulum, traumatic dislocation of the hip joint or disruption of knee ligaments. Periprosthetic fractures of the patella are regarded as a typical complication of total knee arthroplasty (TKA), with an incidence of 0.68% in un resurfaced patellae and up to 21% resurfaced patellae [8].

In addition to that, another study carried out by Allexdandre Felicio Pailo, which is about patellar fractures and knee stiffness analysis indicates that transversal fractures are the most common ones, accounting for 50-80% of the patellar fractures(1,2) comminuted fractures account for 30-35%, and the vertical ones for 12-17%(1). An open-fractures rate of 7% among patellar fractures, with 14.5% being type-I open fractures, 76.4% type II, 1.8% type IIIA, and 7.3% type IIIB, as per Gustillo and Anderson’s classification. Studied 79 patients with patellar open fractures in a total of 226 patients (34%) 15 of them were type-I open fractures, 53% type II, and 32% type III. Related injuries were present in 79% of the cases, being 44% at the ipsilateral lower limb [9].

Patellar fractures are a major obstacle that occurs after the injury and then can lead to challenges related to treatment. So to prevent these problems, surgeons must already have tension band wiring surgery to avoid knee stiffness, etc. as the below researcher indicated in his own study, it revealed that surgical treatment of patella fractures is challenging, with reoperation rates following internal fixation as high as 52%, mostly due to irritation from prominent metallic

implants. High complication rates are common in most metal implants and secondary surgery for removal of prominent implants is often required. The reported rate for secondary implant removal following tension band wiring is 30-52% [10].

Peak age of affected patients is between 20-50 years of age, but in cases of peri-prosthetic fractures the patella is second most commonly injured after the femur and has a reported incidence of 0.05-21% in resurfaced patella [3].

Since there are many more challenges met by our patients operated in hospitals and also the daily follow-up activities in OPD clinics, particularly patients of patellar fractured after fixed with tension band wiring, but there are still no previous studies conducted in the country. As Akhilesh Rathi, an independent researcher, indicated, knee pain, stiffness, kneeling discomfort, and weakness were assessed at weeks (4, 8, 12), and then every 3 months thereafter. The scoring system was modified to include infection [11]. Then our research was focus on the knee stiffness and associated factors in TGSH and FHCSH.

The knee stiffness of patellar fractures and associated factors after fixed with tension band wiring are not studied in Ethiopia. This study was trying to find the knee stiffness and associated factors of patellar fractures after fixed with tension band wiring, it also fills the existing gap of literature and used as baseline study in our hospitals for future other studies.

1.3 Significance of the study

Knee stiffness after tension band wire of patellar fractures is a common problem in our university hospital causing significant morbidity, long hospital stays and frequent clinic follow up. But there is lack of study which shows the incidence, associated factors contributing to it, as well as prevention or treatment strategies of the problems. This study was identify major associated factors contributing to the development of knee stiffness and , were suggest preventive measures and was create awareness of health professionals and (orthopedics ward nurses, residents, consultants, physiotherapy workers), policy makers about the magnitude of the problem and associated factor. This was the first study to be done in our university hospital and Amhara region with this title and will be used as a baseline for other future studies.

2 LITERATURE REVIEW

2.1 Magnitude of Patellar fractures with tension band wire

The study done by C. Gwinner, S. Märdian, Fractures of the patella on 2016, most frequent causes are road traffic accidents in 78.3%, followed by work-related accidents in 13.7% and domestic accidents in 11.4% [84]. Sports-related fractures of the patella are relatively seldom. However, acute dislocations of the patella are associated with osteo-chondral fractures of the patella or fractures of the lateral femoral condyle in up to 70% of cases [8].

Study done by Chaudhary R, Joshi A, from January to June 2015 patients on management's tension band wire after patellar fractures. There were 30 patients, were ported, Majority of patients (93.3%) had their clinical union in less than 8 weeks. Out of 30 patients only two had complications, 1 (3.3%) had knee stiffness and another had k-wire prominence. Based on the Reich & Rosenberg criteria at the end of 24th weeks, our results were graded as excellent in 20 cases (66.7%), well in 8 (26.7%), fair in 2 (6.7%) and none had poor outcome [12].

Similarly 28 patients (93.3%) had no pain and 2 patients (6.7%) had mild knee stiffness and mild pain [13].

Another study mention done by Dr. Kosalaraman Padmanaban, from March 2015 to December-2016 patients on Analysis of percutaneous tension band wiring for patellar fractures. Mean operating time was 30 (range 20 to 50) minutes. The mean follow up period was 8 months (range 6 to 12) months. At the latest follow-up, all patients had good results with painless knee motion, no quadriceps wasting and no subjective disability. Total range of motion was excellent at an average of 142 degrees of knee flexion [14].

This Study also done by Mahindra Gupta1, Manish R Shah2, from 2019 to 2020 on patients Fracture Patella with Tension Band Wiring. Included out of 35 patients, 34 patients 97.14% were happy and satisfied with the treatment and outcome. One patient was not fully satisfied with the outcome as he was advised revision surgery to correct articular step-off. All the patients 100% had returned to the full level of their daily activities. All the patients 100% had returned to their original job. Over all the average union was achieved in 12 to 13 weeks. We have obtained 85.71% of an excellent outcome [7].

The most frequent indirect mechanism is a fall on the feet with eccentrically contraction of the quadriceps muscle. Depending on the velocity of the fall and the resistance of the extensor mechanism, either the patella or the adjacent tendons fail [8].

Most frequent causes are road traffic accidents in 78.3%, followed by work-related accidents in 13.7% and domestic accidents in 11.4%. Sports-related fractures of the patella are relatively seldom. However, acute dislocations of the patella are associated with osteo-chondral fractures of the patella or fractures of the lateral femoral condyle in up to 70% of cases [8].

Study conducted in India by Prakash Ponnan1, Manoj Murungodiyil Kunjappan, from 01 October 2019 to 01 October 2020, patients on management's tension band wire after patellar fractures. There were 36 patients, reported 83 % showed excellent to good outcome and 17 % had fair to poor outcome. Commonest side effects were pins loosening 10 %, non-union 4% & osteoarthritis 5.8 % [12].

Studies reported that age, gender, open or closed fracture, operative technique, or date of publication did not significantly influence the reoperation, infection, or nonunion rate. Their meta-analysis found a 33.6% reoperation rate, an infection rate of 3.3%, and a nonunion rate of 1.3% [9].

2.2 Associated factors of patellar fractures with tension band wiring

2.2.1 Socio-demographic risk factors

Many studies had revealed that functional outcome of patella fractures after fixed with tension band wiring is influenced by multiple factors from socio-demographic risk factors characteristics of age, gender, residence, occupation, educational level, Rural dwellers, urban dwellers, type of injury (closed or open), mechanism of injury (Road Traffic Accidents, Fall down accidents, gun shots, Machine injuries, and stick injury), fracture location (proximal, middle and distal), knee range of motion (passive and active), severity of injury, infections, treatment modality, anatomical reduction and restoration of articular congruity, postoperative rehabilitation or physiotherapy [15].

2.2.2 Tension band wiring

A study conducted in Basaveshwara Medical College and Hospital, Chitradurga, Karnataka, India, the study shows that excellent and good results in 203 patellar fractures which are treated by tension band wiring. The tension band wiring for fractures of patella yields good results as evident in this study. It is inexpensive; the technique is relatively simple with a short period of learning curve.

Modified tension band wiring is most widely used technique in patella fracture fixation nowadays [16].

A study conducted in central institute of Orthopaedics, Vardhman Mahavir Medical College & Associated Safdarjung Hospital, New Delhi India, shows tension band wiring for displaced patellar fractures have also achieved excellent results. In 107 patients with patellar fractures undergoing tension band wire, 102 achieved excellent reduction and good functional results, but in 5 reduction was poor and 3 of them underwent open surgical revision [11].

The modified tension band wire technique showed significant displacement of the fracture gap during cyclic loading. In addition, 22-30% of patients treated with tension band wiring had a displacement of more than 2 mm [17]. Postoperative symptoms and complications related to tension band wire are not rare, and a review found that 22-30% of fractures treated using the TBW technique develop detrimental displacement at the fracture site. Fixation with conventional K-wires has been shown to have a higher rate of implant removal caused by symptomatic irritation, and technical errors, noncompliance, and unknown items are suggested to be the three main factors that lead to fixation failure [17].

The advantage of early mobilization and early return of independent function. With strict adherence to anatomical reduction, aseptic soft tissue handling and soft tissue repair and proper and in time physiotherapy protocol we can get satisfactory results in almost all the patients [7].

According to study conduct in Birendra Army Hospital, Kathmandu, Nepal, January to June 2015 shows 80% of cases treated with modified tension band wiring showed to excellent to good results and 20% showed poor results. 48 in their 100 cases of patella found 81.3% excellent results. Similarly Neumann HS 14 studied 135 fractures of patella which were treated with

modified tension band wiring found 64.7% excellent to good results, 18.8% fair and poor in 16.5% [16].

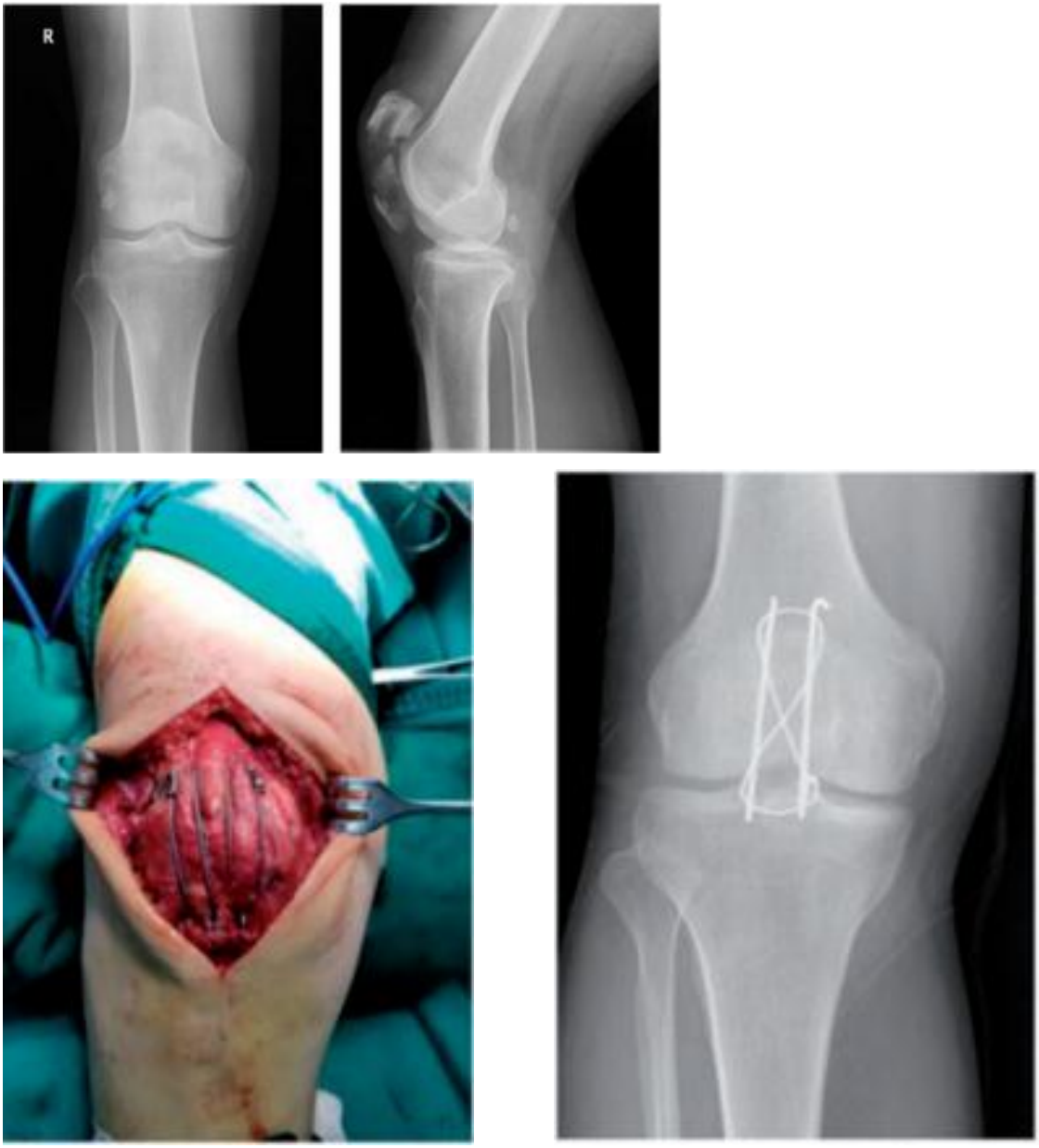

Figure 1: Patellar fracture fixed with tension band wire [17].

2.2.3 Knee stiffness

A study conducted in Hospital University Vall d'Hebron, Barcelona Spain, revealed that Knee stiffness is the most frequent complication after patella fractures after fixed tension band wire. It is highly associated with open fractures, infections, or inadequate rehabilitation protocols with prolonged immobilization. The greater severity of the soft-tissue injury in open fractures facilitate arthrofibrosis and extra-articular adhesions like subcutaneous and quadriceps [18].

A study conducted in department of Orthopaedics, government medical college, Trichur, Kerala, India. Revealed only few complications occurred, with major share belonging to pain on squatting. Majority of patient treated with tension band wiring for patella fracture had excellent to good outcome [19].

A study conducted in china, 2020 revealed postoperative stiffness is a debilitating complication. Anterior adhesions or retractions (joint capsule, quadriceps bursa, quadriceps) were considered the primarily reasons leading to knee stiffness, while the impaired articular surface of patella fractures might be partly responsible for the dysfunction. Various therapeutic methods could be chosen to manage patellar fracture fixed tension band after wire knee stiffness, including manipulation under anesthesia, arthroscopic arthrolysis, and open quadriceps release and so on [20].

The activity of daily living scale of the knee outcome survey was used to assess symptoms and functional capability of the knee. In all the cases, fracture union was achieved at an average of 11 weeks. The average ADLS score was good 92.5 %. Full range of knee motion was achieved by end of the third postoperative month. None of the patients had complications, such as infection and implant failure [6].

The main disadvantage of this method is the need to immobilize the knee for 4 weeks, which may result in stiffness. However, all of the patients achieved full range of motion three months after the surgery. According to reports in the literatures, the early complication rate of tension band wiring ranges from 0% to 25%. Common complications include infection, implant failure, loss of reduction, and wire related problems such as skin impingement, discomfort and pain. In this patient review, none of the patients experienced these problems [6].

2.2.4 Timing of delayed stabilization affects the outcome of patellar fracture healing.

A study conduct in Department of Plastic and Reconstructive Surgery, Stanford University, California, 24 March 2010 , demonstrates that delayed stabilization employed during the first 96 hours of fracture healing leads to a trend of increased chondrogenesis without significantly enhancing fracture repair in mice histomorphometric analyses of the amount of callus tissue and bone that formed at 10 days post-fracture, and biomechanical analyses at 14 days post-fracture, reveal that there are no differences among fractures stabilized immediately and after 24 to 96 hours of instability. A period of 24 to 96 hours of delayed stabilization could have been too short to have an enhancing effect on fracture healing. A previous study in rabbits found that delaying fixation for 10 days enhances fracture healing, but this effect is not observed if the fractures are fixed at 5 or 17 days post-injury. These findings suggest that the timing of delayed fixation may affect the fracture healing outcome. In addition, fractures in this study were stabilized by closed external fixation and only minimal injury was introduced to the callus tissues at the time of stabilization. Compared to delayed internal fixation 4, 9, 10 days, the magnitude of the "second injury" response may have been much lower in our model. Therefore, the effects we observed could be mainly due to delayed stabilization itself and not to a second injury [21].

2.2.5 Infections

The incidence of postoperative infection after fixation of patellar fractures ranged from 3% to 10%, which was similar to the overall incidence of 2.8% in our study. Four patients 5.6% in our series suffered implant failure due to a new trauma, all of whom underwent revision tension band wiring surgery with the both-ends K-wire bending technique [22].

In this study conducted Government Medical College, Trichur, Kerala, India. Report shows 2 (5.71 %) patients had post-operative infection [19].

Study conducted in Journal of the American Academy of orthopedic Surgeons , department of orthopedic surgery, university of Pennsylvania, Philadelphia, April 2011, shows a deep infection is rare, as well zero to 5%, however, the rate is higher for open fractures 11% [23].

Study conducted in Birendra Army Hospital, Kathmandu, Nepal, January to June 2015, the report shows superficial infection which was treated with antibiotics and other one 3.3% had hardware prominence which was later removed after the radiological union. No infection was

reported. Where are 123 found 4 cases of infection out of 45 operated patellar fracture after fixed tension band wiring. Similarly 130 reported 9 cases of failures due to migration of k – wires [12].

2.3 Conceptual Frame Work

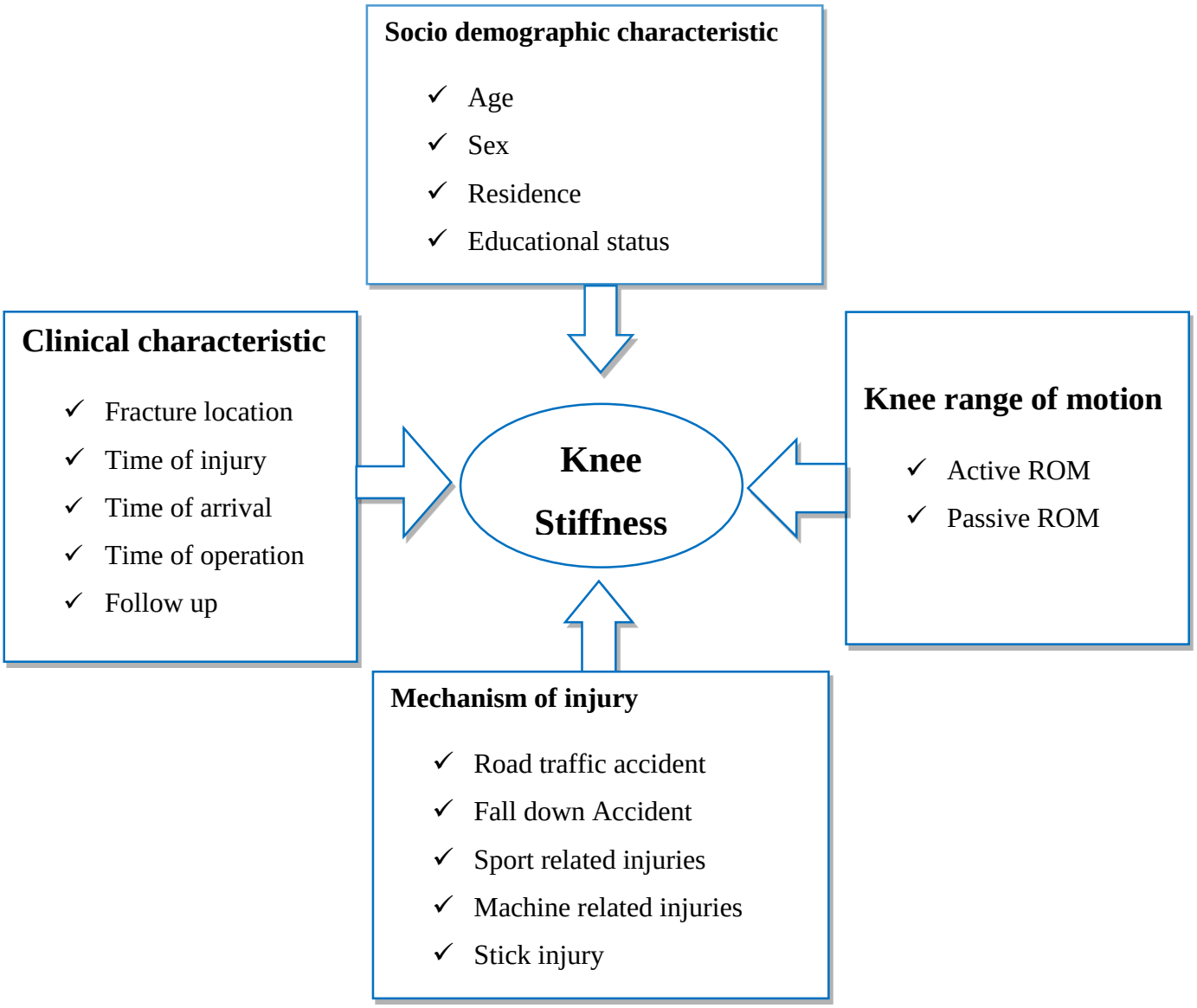

Figure 2: Conceptual framework of independent and dependent variables for associated factor of knee stiffness [24,22,21,20].

3 OBJECTIVES

3.1 General objectives

- To assess knee stiffness of patellar fractures after fixed with tension band wiring & associated factors among patients in tibebe ghion specialized hospital & felege hiwot comprehensive specialized hospital from Augest-1-2019 to Ausgest-1-2022.

3.2 Specific objectives

- To determine the knee stiffness of the patient in the patella fractures after fixed with tension band wiring.
- To identify associated factors of knee stiffness after tension band wire of the patellar fractures.

4 METHODS AND MATERIALS

4.1 Study area

This study was conducted in the department of orthopedics & trauma surgery in tibebe ghion specialized hospital TGSH, Bahir Dar University. Bahir dar is a capital city of amhara region 557.6km from Addis Ababa in north-west Ethiopia. It's a place where Lake Tan resides, which is largest lake in Ethiopia, and the source of Blue Nile River. TGSH is one of the biggest specialized university hospitals in amhara region and in the country at large. It was established in 2018 which landed in an area of 10000sq.metre to primarily give service at a low cost or even free of charge to those that are unable to afford care elsewhere and at the time it was constructed to serve 2000 people per day. The hospital has more than 500 beds in all its wards and over 67 beds in orthopedics and trauma surgery ward; total of 12 orthopedic surgeons (seven general orthopedists, two pediatric orthopedic surgeons, two pelvic trauma and hemi-arthroplasty, one orthopedic sport medicine) and 31 residents specializing in orthopedic surgery. Operations are done 4 days in a week as elective case and daily for emergency cases. The department have its own major operation room with two operating tables, in felegehiwot comprehensive specialized hospital FHCSH, Amhara region, northwest ethiopia, it was established in 1953 E.C, it is estimated to serve 10 million peoples, 1431 staffs (189 admin staff and 333 outsource), the hospital has more than 500 beds in all its wards and over 44 beds in orthopedics and trauma surgery ward, the orthopedics department was established in 2006 E.C[almost 9 years], total of 5 orthopedic surgeons, and 4 to 6 residents specializing in orthopedic surgery from bahir dar university and 16 nurses. Operations are done 3 days in a week as elective cases and daily for emergency cases. The department has its own major operation room with 3 operating tables and it has done 8 to 10 procedures per day currently.

4.2 Study design

A cross sectional study design was using to conduct the study on patients admitted to tibebe ghion specialized hospital TGSH and felege hiwot comprehensive specialized hospital FHCSH from Augest-1-2019 to Ausgest-1-2022. with the diagnosis of patellar fractures and operated with tension band wiring who fulfill the inclusion criteria and were on follow up in TGSH and FHCSH clinic , was reviewed and analyzed.

4.3 Study period

- The study was conducted from August-1-2022 to August-30-2022

4.4 Source of population and study population

4.4.1 Source of population

- All Patients admitting with a diagnosis of patellar fractures in the orthopedic and trauma surgery department at tibebe ghion specialized hosptital TGSH & felege hiwot comprehensive specialized hospital FHCSH from Augest-1-2019 to Ausgest-1-2022.

4.4.2 Study population

- The study populations used for this study were Patients admitting with a diagnosis of patellar fractures in the orthopedic surgery department and operating with tension band wiring at tibebe ghion specialized hospital TGSH & felege hiwot comprehensive specialized hospital FHCSH from Augest-1/2019 to Ausgest-1/2022.

4.5 Eligibility criteria

4.5.1 Inclusion criteria

1. Patients who are ≥ 18 years old, conscious, admitted at orthopedic ward willing to participate in the study was included.
2. Fresh and old patellar fractures.

4.5.2 Exclusion criteria

1. Patients with < 18 years old and mental problem
2. Severe comminuted patellar fractures
3. Patients whose operations are not fully documented on the charts
4. Known knee osteoarthritis OA or rheumatoid Arthritis RA.

4.6 Sampling size determination

The sample size was determined by using single population proportion formula with the following assumptions: prevalence of 17.4% from study conducted at china [17]. Margin of error between sample and population 5%, standard normal distribution value at 95% CI, and Za/2 = 1.96.

Sample size : $n = \frac{Z^2 \mathrm{p}(1-\mathrm{p})}{d^2} = \frac{1.96^2 \mathrm{x} 0.174(1-0.174)}{(0.05)^2} = 221$

With a contingency rate of 10% the final sample size was determined to be 243.

Where:

n= minimum sample size required for the study

Z= standard normal distribution (Z=1.96), CI of 95% = 0.05

P= prevalence of knee stiffness of patellar fracture after fixed with tension band wiring

d=Absolute precision or tolerable margin of error = 5% (0.05)

4.7 Data collection

- Data was collected from charts from hospital records from August-1-2022 to August-30-2022, by three data collectors (one R2 resident, one GP and one nurse) after being trained a head of data collection in the study period, was reviewed a patients with knee stiffness. Data collection format containing variables was prepared.

4.8 Study variables

4.8.1 Dependent variables

- Knee stiffness

4.8.2 Independent variables

Patients factors

- Age
- Sex
- Place/Residence
- Occupation
- Educational Status

Trauma related factors

- Fracture site (Right or left)
- Mechanism of injury
- Fracture location(proximal, middle and distal)
- Type of injury
- Time from injury to definitive surgery
- Knee range of motion ROM
- Follow up
- Infection

4.9 Operational definitions

- **Knee stiffness:** If the patient can't flex the knee more than 90 degrees at 8 weeks.
- **Poor functional outcome:** developing knee stiffness after fixed tension band wire.
- **Infection:** Any discharge noticed from wound site noticed or documented by health professionals.
- **Prominent hardware:** Any implant or metal palpable through skin over the knee.

4.10 Data quality assurance

- Data were collected by three trained persons. To control the quality of data, data collectors (one R2 resident, one GP and one nurse) were given 2 to 3 days long training session on issues regarding data collection**.** In addition, data collection was followed by trained supervisors. Checklist was checked period to data collection and pre-test was done on 5% of study samples at Gamby teaching general hospital.

4.11 Data processing and analysis

- Data was entered, coded, and cleaned using Epi data version 3.1 and exported for further analysis using SPSS windows version 26. Frequency and cross tabulation was used to summarize descriptive statistics. Pie charts and tables were used as appropriate for data presentation and dissemination. Binary logistic regression was used for the presence of associations between variables. Variables with p-value less than 0.25 were included in multivariable analysis. P.value $\leq$ 0.05 was considered as having association at 95% confidence level.

4.12 Ethical clearance

- Ethical clearance was obtained from the IRB of BDU research ethics committee with protocol number: 621/2022. This ethical clearance and cooperation letter was sent to tibebe ghion specialized hospital TGSH & felege hiwot comprehensive specialized hospital FHCSH to obtain consent to perform data collection. Confidentiality of patient information was maintained by taking the data anonymously. The data extracted from checklist was only be used for the study and every data was kept confidential by securing personal information in passwords.

4.13 Dissemination plan

- The finding of the study was presented and submitted to department of Orthopedic Surgery, school of medicine, CMHS, and BDU, as one of the partial fulfillments of specialty certificates. The finding of the study would be shared with ARHB, ESOT, and other concerned bodies. For broader dissemination, the manuscript would be submitted to one of the peer-reviewed journals for publication.

5 RESULT

5.1 Socio-demographic characteristics of the study participants

A total of 243 patients records were reviewed with a response rate. Participant's age ranged from 18 to 80 years with a mean age of the participants was 37.67 years (±14.1). The majority (55.1%) of the participants was males, more than half of the participants (56.4%) were urban residents, and one quarter of the participants were Farmers, the level of education of the participant was no formal education (33.3%), Table-1.

Table 1: Socio-demographic characteristics of patellar fractures in patient at TGSH & FHCSH, 2023(N=243).

Variable	**Category**	**Frequency**	**Percent%**
Sex	Female	109	44.9
	Male	134	55.1
Age	18-30	79	32.5
	31-40	68	28.0
	41-60	63	25.9
	61-80	33	13.6
Resident	Rural	106	43.6
	Urban	137	56.4
Occupation	Government employee	28	11.5
	Merchant	34	14.0
	Labor	43	17.7
	House wife	45	18.5
	Student	31	12.8
	Farmer	62	25.5
Education	No formal education	81	33.3
	Read and write	58	23.9
	Primary education	47	19.3
	Secondary education	35	14.4
	Collage and above	22	9.1

5.2 Clinical characteristics of patients

Regarding the mechanism of injury, most (36.6%) of the fractures resulted from fall down accident. More than half (53.1%) of the patients their fracture location was middle of the patella and more than half (57.6) of the patellar fractures were closed. The mean time of arrival after fracture was 51.2 hours (±26.7), and majority 122 (50.2%) of patients were presented within 1-3 days after injury (Table 2).

Table 2: Clinical characteristics of patellar fractures in patients at TGSH and FHCSH, 2023(N=243).

Variables	**Category**	**frequency**	**Percent %**
Mechanism of injury.	RTA	50	20.6
	Bullet	53	21.8
	FDA	89	36.6
	Stick	51	21.0
Fracture Location.	Proximal	60	24.7
	Middle	129	53.1
	Distal	54	22.2
Type of injury.	Closed	140	57.6
	Open	103	42.4
Time from injury to definitive surgery.	Less than a day	55	22.6
	1 days 3 days	122	50.2
	More than 3 days	66	27.2

5.3 Knee stiffness of patellar fractures after fixed with tension band wire.

Most of the participants 215 (88.5%) didn't develop knee stiffness and around 214 (88.1%) of the patients had positive range of motion of which 185 (76.1%) had active range of motion (ROM). regarding patients follow up 175 (72%) had regular follow up. The majority of the patients 206 (84.8%) were free from infection (Table 3).

Table 3: Knee stiffness of patellar fractures after fixed with tension band wiring in patients at TGSH & FHCSH, 2023, (N=243).

Variable	Category	Frequency	Percent%
Knee Stiffness.	No	215	88.5
	Yes	28	11.5
Knee range of motion.	No	29	11.9
	Yes	214	88.1
Type range of motion.	Passive ROM	30	12.3
	Active ROM	185	76.1
Degree range of motion.	<90	29	11.9
	>90	97	39.9
	Squat (115-120)	117	48.1
Follow-Up.	No	68	28.0
	Yes	175	72.0
Infection.	No	206	84.8
	Yes	37	15.2

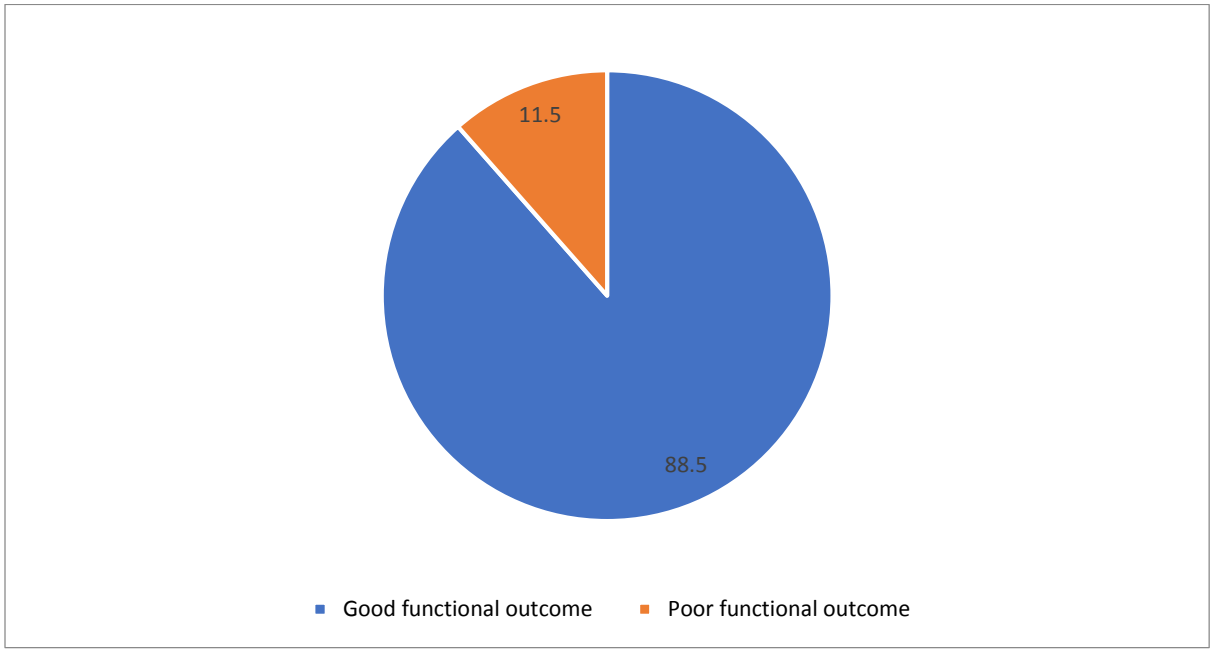

Figure 3: Magnitude of knee stiffness of patellar fractures after fixed with tension band wiring in patients at TGSH & FHCSH, 2023, (N=243).

5.4 Factors associated with knee stiffness

In bivariate analysis, residence, educational status, type of injury, follow up, mechanism of injury, time during arrival, age and infection were associated factor of knee stiffness. After an adjusted for possible effect of confounded variable, follow up (AOR: 7.82, 95%CI: 1.770, 29.96), Time during arrival (AOR: 10.004, 95%CI: 1.10, 90.86), age (AOR: 12.85, 95%CI: 1.144, 144.36), and infection (AOR: 6.71, 95%CI: 1.653, 27.29) were the factors significantly associated with the knee stiffness.

Patients who had not had regular follow up were nearly 8 times more likely to develop knee stiffness as compared to Patients who had regular follow up (AOR: 7.82, 95%CI: 1.770, 29.96). Patients who arrival at the hospital more than 3 days after the injury were 10 times more likely to develop knee stiffness as compared to those arrived less than 3 day (AOR: 10.004, 95%CI: 1.10, 90.86).

The odds ratio of knee stiffness were nearly 13 times higher in the 61-80 year age group compared to the 18-30 year age group (AOR: 12.85, 95%CI: 1.144, 144.36).
Patients with infection were nearly 7 times more likely to develop knee stiffness (AOR: 6.71, 95%CI: 1.653, 27.29) than those without infection.

Table 4: Factors associated with knee stiffness of patellar fractures patients at TGSH & FHCSH, 2023, N=243.

Variable	**Category**	**Knee stiffness**		**COR(95% CI)**	**AOR(95% CI)**	**P-value**
		No	**yes**			
Residence	Rural	90	16	1	1	
	Urban	125	12	0.540 (0.244, 1.197)	5.71 (0.179, 182.3)	0.324
Educational status	No formal education	64	17	2.65 (0.564, 12.50)	10.99 (0.213, 567.8)	0.234
	Read and write	57	1	0.175 (0.015, 2.041)	0.272 (0.013, 5.589)	0.390
	Primary education	42	5	1.190 (0.212, 6.676)	0.670 (0.059, 7.57)	0.746
	Secondary education	32	3	0.938 (0.144, 6.110)	0.698 (0.05, 9.425)	0.787
	Collage and above	20	2	1	1	
Mechanism of the	RTA	46	4	1	1	

injury	Bullet	43	10	2.674 (0.780, 9.166)	2.748 (0.305, 24.72)	0.367
	FDA	79	10	1.456 (0.432, 4.907)	3.82 (0.420, 34.79)	0.234
	Stick	47	4	0.979 (0.231, 0.149)	1.71 (0.133, 22.02)	0.681
Type of injury	Closed	130	10	1	1	
	Open	85	18	2.753 (1.213, 6.25)	2.80 (0.570, 13.79)	0.205
Follow-up	Yes	45	23	1	1	
	No	170	5	17.37 (6.258, 48.26)	7.82 (1.770, 29.96)	**0.006**
Time during arrival	Less than a day	53	2	1	1	
	1 days to 3 days	116	6	1.371 (0.268, 7.017)	5.037 (0.562, 45.17)	0.149
	More than 3 days	46	20	11.52 (2.55, 51.96)	10.004 (1.10, 51.86)	**0.041**
Age	18-30	78	1	1	1	
	31-40	65	3	3.60 (0.366, 28.44)	1.405 (0.096, 20.55)	0.804
	41-60	57	6	.(8.21, 0.962, 40.09)	5.62 (0.543, 32.31)	0.148
	61-80	15	18	93.6 (15.59, 115.3)	12.85 (1.144, 41.36)	**0.039**
Infection	No	193	13	1	1	
	Yes	22	15	10.12 (4.267, 24.01)	6.71 (1.653, 27.29)	**0.008**

6 DISCUSSION

The main purpose of this study to determine the knee stiffness of patellar fractures and associated factors after fixed with tension band wiring in patients at tibebe ghion specialized hospital and Felege hiwot comprehensive specialized hospital, Bahir dar, Ethiopia.

The findings of this study, poor knee stiffness was highly reported among rural dwellers (106, 15.1%), patients with open wound injuries (103, 17.4%), and those patients arrived at the hospital more than three days (66, 30.3%). This study also showed that the overall knee stiffness of patellar fractures after fixed with tension band wiring was good (215, 88.5%) while the poor knee stiffness was (28, 11.5%). Regarding the magnitude of poor knee stiffness of patellar fracture after fixed with tension band wired, our finding is higher than the study conducted in Nepal which was found (6.7%) of poor knee stiffness [12]. However, this study found a lower magnitude of poor knee stiffness as compared to study conducted in India which was found poor knee stiffness of (17%) [19]. This discrepancy might be due to the difference in the study population, different hospital setup, different geographical regions, as well as different context in different countries.

In this study lack of follow up (AOR: 7.82, 95%CI: 1.770, 29.96), Time during arrival (AOR: 10.004, 95%CI: 1.10, 90.86), patients aged between 61 up to 80 years (AOR: 12.85, 95%CI: 1.144, 144.36), and infection (AOR: 6.71, 95%CI: 1.653, 27.29) were found to be independent factors for poor knee stiffness.

In this study, the odds of having poor knee stiffness of patellar fractures after fixed with tension band wiring was eight-folds higher among patients who had not had regular follow up compared to patients who had regular follow up, this is because follow up will start by evaluating the condition carefully, with an examination of the overall health, daily activities, and the nature of the symptoms. Evaluation of the joint itself and the ability to move it will also be a crucial part of the follow up evaluation, as it can reveal exactly what the underlying problem is. This will lead toward the recommendation of specific types of physiotherapy and reduce the development of joint stiffness and prevent the underlying cause of stiffness [25]. Those individuals with follow-up are given an appropriate and regular exercise program, which can help reduce stiffness and pain, increase flexibility, improve endurance, develop muscle strength, improve sleep, and keep bone and cartilage healthy [26].

In this study, Patients who arrival at the hospital more than 3 days after the injury were 10 times more likely to have poor knee stiffness as compared to those arrived less than 3 day, the possible explanation of this is delayed stabilization during the early stages of fracture repair influences cartilage formation in the callus. Compared to fractures stabilized immediately after injury, a trend towards more cartilage formation was observed in fractures stabilized at 24 to 96 hours, Growing evidence indicates that the mechanical environment plays a crucial role in cell differentiation during fracture repair. In a theoretical model, compression induces chondrocyte differentiation while tension leads to the formation of fibrous tissue [21].

In this study, those patients aged 61-80 year were almost thirteen-folds more likely to had poor knee stiffness after fixed with tension band wire compared to the 18-30 year age group, this is supported by the facts that recovery may be more complex and prolonged in older patients because physical changes that occur in the body as a result of aging. Most of older patient's skin and muscles become thicker and bone strengths may be weaker, these age related changes may delay healing and leave the older patients prone to other complications such as infection and joint stiffness after fixed tension band wire [27].

In this study, the odds of having poor knee stiffness of patellar fractures after fixed with tension band wiring was nearly seven-folds higher among patients who develop infection compared to patients who had no infection, the possible explanation of this could be the residual pathological tissues would cause persistence of infection or further result in knee joint infections, necrotic and inflammatory tissues were found in the deep end of sinus tract, and the abnormal tissues were close to the wires. It is well-know that bacterial adhesion and biofilm formation on implant surfaces could shelter the bacteria and encourage persistence of infection which could lead to poor knee stiffness [20].

7 STRENGTH AND LIMITATIONS OF THE STUDY

7.1 Strength of the study

- Medical records of patients were properly handled and most of the information related to patient of patellar fractures after fixed with tension band wire was obtained.

7.2 Limitation of the study

- This study does not show cause and effect relationships because of the cross-sectional study design.
- Small sample size
- Incomplete charts

8 CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

This study showed that the overall poor knee stiffness of patellar fractures after fixed with tension band wiring was low in this study area, lack of follow up, Time during arrival (patients arrived at the hospital more than 3 days), patients aged between 61 up to 80 years and infection were factors significantly associated with poor knee stiffness of patellar fractures after fixed with tension band wire.

8.2 Recommendations

For the department of orthopedics and traumatology surgery in both TGSH and FHCSH

- Early initiation of antibiotics for compound patellar fractures should be advocated for all.
- All patients with patellar fractures should be given early proper stander of care management.
- Elder patients of patellar fractures should be given constant care and proper attention.
- Patients follow up should be regular at orthopedic and trauma referral clinics.

For the Amhara regional Health Bureau

- To raise public health awareness those patients with traumatic patellar fractures in order to prevent all delays like hospital delay, early management delay and operation delays.
- Regional health bureau should improve transportation facilities for patient traumatic patellar fractured in rural dwellers.

For Researchers

- Researchers who are interested to conduct on functional outcomes of patellar fractures and associated factors after fixed tension band wiring should better to include qualitative approach to investigate in detail on extra determinant factors of functional outcomes of patellar fractures after fixed tension band wiring.

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10 ANNEXES

10.1 Information Sheet and Consent Form

Title of the Research Project: Assessment knee stiffness of patellar fractures and associated factors after fixed with tension band wiring in patients at tibebe ghion specialized hospital and felegehiwot comprehensive specialized hospital (TGSH and FHCSH) 2023, Bahir Dar, Amhara region, Ethiopia.

Name of Investigator: Sahal Ahmed (MD, Orthopedics and Trauma, Fourth Year Resident)

Name of the Organization: Bahir Dar University, college of medicine and health sciences.

Name of the Sponsor: Bahir Dar University

Introduction: This information sheet is prepared for Bahir Dar University, college of medicine and health sciences administration to make concerned offices clear about the purpose of research thesis, data collection procedures and get permission to conduct the research.

Purpose of the Research Project: Was to know knee stiffness of the patellar fractures and associated factors after fixed with tension band wiring, finally it was identify associated factors which determine knee stiffness of patellar fracture.

Procedure: In order to achieve the above objective, information which is necessary for the study was taken from medical records of the patients and clinical evaluations.

Risk: By participating in this research project you may feel that it has some discomfort especially on wasting your time (a minimum of 40 minutes) but this may not be too much. There is no risk in participating in this research project.

Benefit: If you are participating in this research project, there may not be direct benefit to you but your participation is likely to help us in showing the determinant knee stiffness of patellar fracture and associated factors after fixed with tension band wiring and will help us act accordingly afterwards.

Confidentiality: The information collected for this research project will kept confidential and information about you that will be collected by this study will be stored in a file, without your name, but a code number assigned to it. And it will not be revealed to anyone except the principal investigator and assistants will be kept locked with key.

Right to Refusal: you have the full right to refuse from participating in this research. This will not affect you from getting any kind of health service. You have also the full right to leave from this study at any time you wish, without losing any of your right.

Person to contact: This research project will be reviewed and approved by the ethical committee of the Bahir Dar University. If you want to know more information you can contact the committee through the address below. If you have any question you can contact any of the following individuals and you may ask at any time you want.

Tel +252907626550 Or +2510935014177

E-mail:Drsahal79@gmail.com

10.2 Data collection/Format checklist

Part: I Socio demographic characteristics			
No	**Variables**	**Category**	**Remark**
101	Age group	A. 18 to 30 B. 31 to 40 C. 41 to 60 D. 61 to 80	
102	Sex	1. Male 2. Female	
103	Residence	1. Rural 2. Urban	
104	Occupation	1. Government employ 2. Merchant 3. Labor 4. Student 5. House wife 6. Farmer 7. Others	
105	Educational status	1. Read and write 2. No formal education 3. Primary education 4. Secondary education 5. College and above	
Part II: Trauma related factors			
201	Knee stiffness	1. Yes 2. No	
202	Fracture side	1. Left 2. Right	
203	Mechanism of injury	1. RTA 2. Bullet	

		3. Fall down 4. Stick 5. Other	
204	Fracture location	1. Proximal 2. Middle 3. Distal	
205	Type of injury	1. Closed 2. Open	
206	Time from injury to definitive surgery	1. Less than a day 2. One day to three days 3. More than a three days	
207	Type of reduction	1. Open 2. Closed	
208	Knee range of motion exercise (Y / N)	1. Yes 2. No	If no skip to Q210
209	If yes to knee range of motion (ROM)	1. Active range of motion 2. Passive range of motion by physiotherapist 3. CPM by machine	
210	Follow up	1. Yes 2. No	
211	Degree knee range of motion on follow up	1. <90 degree 2. >90 degree 3. Squat(115-120) degree	
212	Infection	1. Yes 2. No	