PREVALENCE OF ANTERIOR CRUCIATE LIGAMENT TEAR AND ASSOCIATED INJURIES AMONG PATIENTS WHO UNDERWENT KNEE MAGNETIC RESONANCE IMAGING ATTIKUR ANBESA SPECIALIZED HOSPITAL, ADDIS ABABA UNIVERSITY AND SAINT PAUL HOSPITAL MILLENNIUM MEDICAL COLLEGE, ADDIS ABABA, ETHIOPIA, FROM MARCH 2019 to MARCH 2021 G.C.

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Prevalence Of Anterior Cruciate Ligament Tear And Associated Injuries Among Patients Who Underwent Knee Magnetic Resonance Imaging At Tikur Anbesa Specialized Hospital, Addis Ababa University and Saint Paul Hospital Millennium Medical College, Addis Ababa, Ethiopia.

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A final Research Paper for Preparation of Senior Paper to be submitted to the Radiology Department, College of Health Science, Addis Ababa University in Preparation for Partial Fulfillment of the Requirements for the Post Graduate Study in Radiology.

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Contents

ABBREVIATION

AAU-Addis Ababa University

ACL- Anterior cruciate ligament

AMTS- Anterior medial tibial spine

CHS- College of Health Science

FCL- Fibular collateral ligament

Hx- History

MRI- Magnetic Resonance Imaging

MCL- Medial collateral ligament

MPLFC- Mid part of lateral femoral condyle

MTP- Medial tibial plateau

PCL- Posterior cruciate ligament

PLCI- Posterolateral corner injury

PT- Popliteus tendon

PFL- Popliteofibular ligament

PLTP- Posterolateral tibial plateau

RTA- Road traffic accident

SPHMMC- Saint Paul Hospital Millennium Medical College

TASH- Tikur Anbesa Specialized Hospital

LIST OF FIGURE

LIST OF TABLE

ABSTRACT

The knee joint is prone to injury because of its complexity and weight-bearing function. The Anterior cruciate ligament (ACL) is the one of the most commonly injured knee ligaments and are common in young individuals who participate in sports activities associated with pivoting, decelerating and jumping. However there is shortage of information regarding prevalence of anterior cruciate ligament tear especially in Ethiopia. This is a cross sectional study done to assess prevalence of Anterior Cruciate ligament tear and associated injuries among patients who underwent Knee Magnetic resonance imaging from March 2019 to March 2021 at Tikur Anbesa Specialized Hospital and SPHMMC. SPSS version 26.00 was used for data analysis. The finding showed the knee pain is one of the commonest clinical presentation and joint effusion as well as abnormal T2/PD signal intensity are the common MRI findings of ACL tear. The findings also showed 39.2% the patients had history of trauma of which 17.2% have anterior cruciate ligament tear. Majority (91.6%) of ACL tear were associated with other injuries in the knee joint. Osseous injuries (50%) either contusion or avulsion and Meniscal tears (55.5%) are the commonly associated injuries with ACL tear with the medial meniscus being the commonly affected meniscus. Postero lateral corner injury was also seen in 5.5%, Posterior cruciate ligament injury in 8.3%, medial collateral ligament in 19.4% and associated osseous avulsion fracture is seen in 13.9% of patients with ACL injury. Males (58.3%) are highly affected with ACL tear than females (41.7%).The prevalence of ACL tear is high in young individual with history of falling down accident and twisting injury. Whenever there is ACL injury evaluation for presence and pattern of any other injury in the knee joint is recommended.

Key word: Anterior cruciate Ligament Tear, Knee MRI, Ethiopia.

1. INTRODUCTION

1.1. Back ground

The knee joint is prone to injury because of its complexity and weight-bearing function. It is made up of the tibia, femur, and patella, which are stabilized by the medial collateral ligament, lateral collateral ligament, posterior cruciate ligament, and anterior cruciate ligament (ACL).Anterior cruciate ligament (ACL) injuries are common in young individuals who participate in sports activities associated with pivoting, decelerating and jumping. Tears of the anterior cruciate ligament (ACL) are among the most frequently studied injuries in the orthopaedic cases. (1).

Knee joint in the human body has many complex anatomies. It is a mobile trochoginglymus, which allows flexion and extension as well as a slight medial and lateral rotation. The total range of motion depends upon several parameters such as soft-tissue restraints, active insufficiency, and hamstring tightness (2).The ligaments surrounding the knee joint offer stability by limiting movements, together with several menisci and bursae, shield the articular cartilage, and capsule. The knee permits flexion and extension about a virtual transverse axis, and a slight medial and lateral rotation about the axis of the lower leg in the flexed position(3).

The anterior cruciate ligament (ACL) originates from the medial and anterior aspect of the tibial plateau and runs superiorly, laterally, and posteriorly toward its insertion on the lateral femoral condyle. The ACL consists of two major fiber bundles, namely anteromedial and posterolateral bundles. Together, these bundles provide approximately 85% of total restraining force of anterior translation. The ligament is 31-35 mm in length. The primary blood supply to the ligament comes from the middle geniculate artery. The posterior articular nerve, a branch of the tibial nerve, transmits pain in the intrafascicular spaces(4, 5).

1.2. STATEMENT OF THE PROBLEM

Anterior cruciate ligament (ACL) ruptures are among the most commonly studied injuries in orthopaedic case. The prevalence of ACL ruptures is estimated to range from 30 to 78 per 100,000 per year. (6). It is estimated that in the United States of America (USA), there are 200,000 Anterior cruciate ligament injury which require constructive surgery(7, 8).

ACL injury can affect activities of daily living. Because of the high costs of surgery and rehabilitation and the substantial time needed for rehabilitation, primary and recurrent ACL tear represent a major economic burden and may end the careers of individual(9).

ACL failure has been linked to heavy or stiff-legged landing; as well as twisting or turning the knee while landing, especially when the knee is in the valgus position. The discrepancy of prevalence of ACL tear among gender has been attributed to differences between the sexes in anatomy, general muscular strength, reaction time of muscle contraction and coordination, and training techniques. Study suggests hormone-induced changes in muscle tension associated with menstrual cycles may also be an important factor(10).

MRI has a higher accuracy than clinical examination in detecting ACL tears when multiple ligament injuries are involved. Current studies on ACL injuries have focused on trying to explain which sports place an athlete at greatest risk for ACL injuries, or why female athletes are more likely to suffer from ACL injuries than male athletes in a given sport(11). However, very little research has been conducted on how the prevalence or numbers of new cases per year, of ACL injuries compare among different countries. Therefore, this study was aimed to assess the prevalence of Anterior Cruciate Ligament Tear at different population among patient who underwent Knee magnetic resonance imaging at Tikur Anbesa Specialized University Hospital and Saint Paul Millennium Medical College, Ethiopia from March, 2019 to March, 2021.

1.3. Significance of the study

The study findings will be used by health institution to obtain an optimum outcome of treatment, health care teams should be well trained in caring for these injured patients with current precaution protocols and treatments. In addition the study aims to identify MRI pattern of ACL. The finding of this study will also help policy makers and planners to set their target with interventions in the study area. It may also help as baseline for another study.

1.4. Objective

1.4.1. General Objective

To assess prevalence of Anterior Cruciate ligament tear and associated injury among patients who underwent Knee MRI within the last two years in Tikur Anbesa Specialized Hospital and Saint Paul Hospital Millennium medical college from March 2019 to March 2021.

1.4.2. Specific Objective

To determine prevalence Anterior Cruciate ligament tear

To assess causes of Anterior Cruciate ligament tear

To assess the prevalence of commonly associated injuries with ACL tear

To see the sociodemographic characteristics of ACL tear

2. LITERATURE REVIEW

2.1. prevalence of Anterior Cruciate Ligament Tear

Study conducted in Saudi Arabia, among the Saudi Community in Jeddah City, on Prevalence of Anterior Cruciate Ligament Injury and other Ligament Injuries showed the prevalence of ACL and other cruciate ligaments injury is 26.2% According to this study the prevalence of ACL tear was 14.5%(41/282) of which 68.9% of cases tear was partial, and 31.3% complete(12).

Study conducted on Incidence of Anterior Cruciate Ligament Tears and Reconstruction in Minnesota showed that the overall age- and sex-adjusted annual incidence of ACL tears was 68.6 per 100,000 years(13).Study from South mead Hospital, Bristol showed The incidence of ACL ruptures is estimated to range from 30 to 78 per 100,000 years(6).

The study from Scandinavian and continental European countries, New Zealand, and the United States are fairly similar (annual incidence rates of 0.03%–0.04%), whereas the studies from the United Kingdom reported lower rates (0.01%–0.02% annual incidence)(14, 15)

Study conducted on Incidence of anterior cruciate ligament injury in a rural tertiary care hospital Jawaharlal Nehru Medical College, Sawangi, Maharashtra, India found that the most common injury noted was the ACL tear accounting for a whopping 70% of the knee injuries(16).

Study conducted on Epidemiology of Recurrent Anterior Cruciate Ligament Injuries in National Collegiate Athletic Association Sports Maryland USA showed that of 350,416 AEs, there were 1105 ACL ruptures, 126 of which were recurrent(17).

Study conducted on Annual Incidence of ACL Injury in Various Populations in Australia showed annual incidence of ACL tear rates range from 0.01% to 0.05%. With the median annual incidence of 0.03% for these countries(18).

2.2. Age and sex relationship with ACL tear

Study conducted in Saudi Arabia, among the Saudi Community in Jeddah City, on Prevalence of Anterior Cruciate Ligament Injury and other Ligament Injuries showed that the prevalence was significantly higher in male patients than in female (91.9 vs 8.1%). The age of the studied ACL injury cases ranged from 13 - > 50 years with mean age (± SD) was 38.0 ± 12.2 years(12).

Study conducted on Incidence of Anterior Cruciate Ligament Tears and Reconstruction in Minnesota showed that the incidence was significantly higher in male patients than in females (81.7 vs 55.3 per 100,000). The incidence of isolated ACL tears decreased significantly over time in males (P.001) but remained relatively stable in females. Age-specific patterns differed in male and female patients, with a peak in incidence (241.0 per 100,000) between 19 and 25 years in males and a peak in incidence (227.6 per 100,000) between 14 and 18 years in females(13).

Study conducted on Incidence of anterior cruciate ligament injury in a rural tertiary care hospital Jawaharlal Nehru Medical College, Sawangi, Maharashtra, India found that men are more prone to have ACL injury than women in rural population. Patients falling in the age group of 16-25 years of age are more prone to have ACL injuries in rural population(16).

Another study conducted on Epidemiology of Recurrent Anterior Cruciate Ligament Injuries in National Collegiate Athletic Association Sports Maryland USA showed that of sports played by athletes of both sexes, women's soccer had a significantly higher rate of recurrent ACL ruptures than men's soccer. Among all sports, men had a significantly higher rate of recurrent ACL ruptures (4.3) than women (3.0). Overall, the ratio of recurrent to primary ACL ruptures decreased over the 10-year study period. Both women and men had a decreasing trend of recurrent to primary ACL ruptures, although women had a steeper decrease(17).

2.3. Injury associated with ACL tear

Study conducted on assessment of anterior cruciate ligament tear in Chicago indicated that injuries associated with ACL tear are medial meniscal tear, lateral meniscal tear which accounts 20.9% and 15.6% respectively. In addition medial and lateral bone marrow compartment injury accounts for 4.3% and 33.1% respectively(19).

In addition the study from Stanford medical center on Anterior Cruciate Ligament Tears and Associated Injuries showed on 5% of ACL injuries, there may be an avulsion fracture of the tibial eminence(11).

Study conducted on Posterolateral corner injuries: Epidemiology, anatomy, biomechanics and diagnosis at University of Cambridge showed 4 (2.1%) had isolated Posterior ligament corners tears. On the other hand the study from Germany Essen Hospital on Epidemiology of posterior cruciate ligament injuries showed (47%) patients had isolated PCL ruptures(20, 21)

3. STUDY AREA AND PERIOD

The study was conducted at Addis Ababa University College of health science, Tikur Anbesa specialized Hospital and Saint Paul millennium medical college. TASH is one of the largest hospitals found in nation's capital city Addis Ababa. It is one of the largest referral centers of the country and the main teaching hospital. The hospital provides a tertiary level referral treatment with over 900 beds and is open 24hrs for emergency services. SPMMC also one of the largest Hospitals found in nations capital city Addis Ababa and as well as it is one of the referral center of the country and the main teaching hospital.

3.1. Study Design

Retrospective cross-sectional study design was conducted.

3.2. Source Population

All patients who underwent Knee MRI at TASH and SPHMMC from March 2019 to March 2021 G.C considered as source population.

3.3. Study population

All patients who underwent Knee MRI at TASH and SPHMMC from March 2019 to March 2021 G.C.

3.4. Inclusion and Exclusion Criteria

3.4.1. Inclusion Criteria

All patients evaluated with Knee MRI in the specified period were included.

3.4.2. Exclusion criteria

Incomplete patient record was excluded.

3.5. Sample size determination and sampling technique

The actual sample size was calculated using single population proportion formula

$$n= \frac{Z@/2P(1-P)}{d^2}$$

Where P= Prevalence of Anterior Cruciate ligament tear from previously conducted study which is 14.5%(12).

d =the margin error between the sample and the population is 5%.

Z α/2= critical value at 95% confidence level of certainty (1.96).

The calculated sample size (n) = $(\frac{1.96)^2 * 0.05(1-0.145)}{(0.05)^2} = 190$

Adding 10% non-respondent the total sample size is 209.

3.6. Sampling technique

First a list of all patients who underwent knee MRI over specified period was prepared and the total Knee MRI was 315. Then each MRI marked with ID number of the patients and from these 315 MRI 209 was selected by simple random sampling technique by drawing each ID number from the box randomly to choose the sample until the sample size filled. (A.k.a Method of lottery).

3.7. Data collection instrument and procedure

3.7.1. Data collection tool

Data was collected using structured data extraction sheet from Picture Archive Communication System. Patient information like Socio-demographic characteristics such as age sex, causes of injuries will be included from chart of the patient. Patient's image and the MRI reports were reviewed and findings recorded in the data extraction sheet.

3.7.2. Data collection procedure

Knee MR Images were acquired using Philips Medical Systems Achieva 16 channels1.5 T strength MR scanner with standard knee receiving coils. Images were acquired in sagittal plane in T1 weighted TSE, PD SPAIR and in sagittal plane in T2 weighted SPIR with 4 mm slice thickness and slice gap of 5 mm. The axial plane acquired in PD SPAIR with 5 mm slices thickness and slice gap of 5 mm. The coronal plane acquired in T2 TSE, PD SPAIR and FLAIR with 4.2mm slice thickness and slice gap of 5mm.

The card information reviewer was informed about the objective of study by the principal investigator (PI). The data will be collected by R3 radiology residents. Image is reviewed as well as compared with report.

3.8. Study variable

3.8.1. Dependent variable

Anterior cruciate ligament tear

Posterolateral corner injuries

Posterior cruciate ligament tear

3.8.2. Independent variable

-Age

-Gender

- Occupation

- Cause of Anterior cruciate ligament injury

3.9. Operational definition

1. Ligament tear: - is when there is partial or complete discontinuity/signal change of the fibers of the ligament.
2. Acute ACL tear: -suggested if the ligament was focally or diffusely disrupted and if soft-tissue edema was present.
3. Chronic ACL tear: -suggested if the ligament was focally or diffusely disrupted without evidence of significant edema or Laxity with intermediate signal intensity and thickening of the ligament.
4. Complete tear: -suggested if the ligament was completely interrupted.
5. Low grade partial tear: - suggested when only less than or about 50% of the fibers torn.
6. High grade partial tear: - Abnormal Lachman but not completely disrupted, usually ≥ 50% of ligamentous cross section disrupted.
7. Anteromedial bundle: - It is part of ACL which is located proximal and anterior in the femoral ACL origin and inserts in the anterior part of the tibial spine.
8. Posterolateral bundle:-It is component of ACL which starts in the distal and posterior aspect of the femoral ACL origin and inserts in the posterior parts of tibial spine.
9. Low grade Posterolateral corner injury:-Edema without complete disruption of FCL, popliteus tendon, or PFL

10. High-grade Posterolateral corner injury: Disruption of popliteus, PFL, ± FCL

3.10. Data quality control

Two day training was given for both data collectors regarding the objective of the study, data collection tool, ways of data collection, checking the completeness of data collection tool and how to maintain confidentiality. Proper coding and categorization of data was maintained for the quality of the data to be analyzed. All data was checked for completeness, accuracy, clarity and consistency by principal investigator and supervisors before data entry in to software. Simple frequencies and cross tabulation was done for missing values and variables.

3.11. Data Processing and Analysis

The collected data was checked for completeness, cleaned, edited, coded and entered into Epi data version 3.1 to minimize logical errors and design skipping patterns. Then, the data was exported to SPSS window version 26 for analysis. Descriptive analysis was done by computing proportions and summary statistics. Then the information was presented by using simple frequencies, summary measures, tables and figures.

3.12. Ethical Consideration

Ethical clearance was obtained from written ethical clearance letters was obtained from the departments' research and ethics committee. Any piece of information was kept confidential by keeping anonymity of the study subjects. A formal letter of permission and support was written to radiology department. Then informed, voluntary, written and signed consent was obtained from the radiology department head.

4. RESULT

In this study out of 209 review patient card 115(55%) were male. In addition, 64.1% found in the age of less than 34 years. The mean age of patients was 35(+/-14.8SD).On the other hand sportsmen accounts for 4(1.9%) (Table1).

Table 1: Socio-demographic characteristics of patients who underwent Knee MRI at TASH and SPHMMC, from March 2019 to March 2021 G.C (N=209).

Variable	Category	Frequency	Percentage
Sex	Male	115	55
	Female	94	45
Age	Less than 25	63	30.1
	25-34	48	23.0
	35-44	38	18.2
	Greater than 45	60	28.7
Occupation	Gov't employee	47	22.5
	Sport men	4	1.9
	Car driver	7	3.3
	Merchant	20	9.6
	Farmer	43	20.5
	Student	44	21.0
	Others	44	21.0

From the included patient record 139(66.5%) were from SPHMMC and 110 (52.6%) were left knee MRI. Among the reviewed patients record 82(39.2%) had history of trauma and 89% presented with knee pain (Table 2).

Table 2: Traumatic history and clinical presentation of patients who underwent Knee MRI at TASH and SPHMMC, from March 2019 to March 2021 G.C (N=209).

Variable	**Category**	**Frequency**	**Percentage**
Had Hx of trauma	Yes	82	39.2
	No	127	60.8
Clinical Presentation	Knee pain	186	89
	Knee swelling	96	45.9
	Inability to walk	41	19.6
	Other	6	2.9
Cause of Injury	Sport activity	15	7.2
	RTA	15	7.2
	Falling down	28	13.4
	Twisting injury	19	9.1
	Other	5	2.4

This study showed that from the total study participant 36(17.2%) have ACL tear of which 16(7.7%) is acute complete tear and 44% of patients with history of trauma had ACL tear as well as 2.4% patients without history of trauma have ACL tear (Table 3).

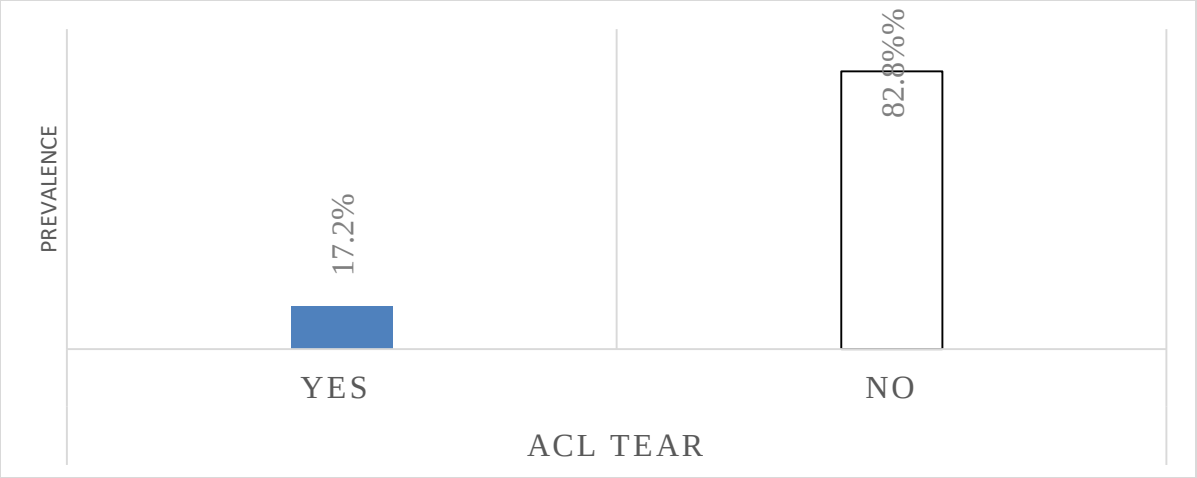

Figure 1: Prevalence of ACL tear among patients who underwent Knee MRI at TASH and SPMMC, from March 2019 to March 2021 G.C (N=209).

Table 3: Prevalence of ACL tear, type of ACL tear and related MRI findings of patients who underwent Knee MRI at TASH and SPHMMC, from March 2019 to March 2021 G.C (N=209).

Variable	**Category**	**Frequency**	**Percentage**
Which side torn(n=36)	Right knee ACL	18	50
	Left Knee ACL	18	50
MRI finding (Primary sign)	Swelling	12	33.3
	Increase signal on T2/PD	27	75
	Fiber discontinuity	26	72.2
	Empty notch sign	4	11.1
	Abnormal orientation to blumensaat line	6	16.7
MRI (secondary sign)	Uncovered Lateral Meniscus	1	2.8
	Anterior tibial translocation sign	4	11.1
	Positive PCL line sign	1	2.8
	Angulation of PCL	3	8.3

	Joint effusion/ Hemarthrosis/Lipoarthrosis	29	80.6
If partial ACL tear ,w/c bundle is torn(n=16)	Anteromedial	2	12.5
	Posterolateral	4	25
	Unknown	10	62.5

Types of ACL tear

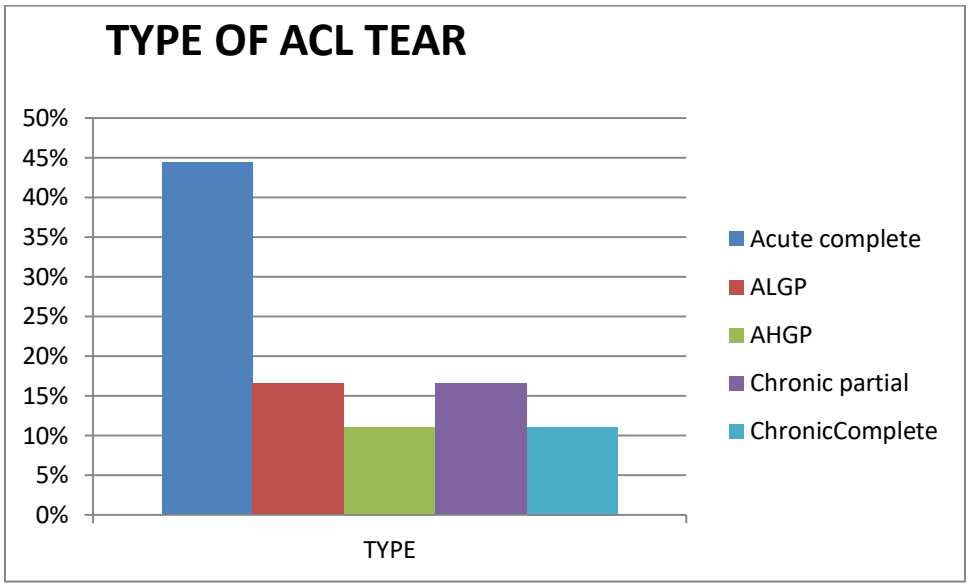

Figure 2: Type of ACL tear among patients who underwent Knee MRI at TASH and SPHMMC, from March 2019 to March 2021 G.C (N=209).

Associated injury with ACL tear

This study also assessed injury associated with ACL tear. Majority (91.6%) of ACL tear is associated with other injuries with the commonest associated injury being meniscal injury(55.6%) and osseous injuries (50%)followed by PCL injury and posterolateral corner injuries .Medial meniscus tear is commoner (30.5%) than the lateral meniscus (table 4).

Table 4: Ligament and meniscal injury associated with ACL among patients who underwent Knee MRI at TASH and SPHMMC, from March 2019 to March 2021 G.C (N=209).

Variable	Category	Frequency	Percentage
Associated injury with ACL tear (n=36)	Yes	33	91.6
	No	3	8.4
Associated Ligament injury	Yes	10	27.8
Which ligament	Medial collateral ligament injury	7	19.4
	Posterior cruciate Ligament injury	3	8.3
	Posterolateral corner injury	2	5.5
W/c component of PLC injured	Popliteus tendon	1	2.7
	Fibular collateral	1	2.7
Grade PLC injury	Low grade	2	5.5
	High grade	0	0
PCL injury(n=36)	Yes	3	8.3
Type of PCL	Partial tear	2	5.5
	Complete	1	2.7
Meniscal tear (209)	Yes	43	20.6
	No	166	79.4
Meniscal injury Associated with ACL tear (n=36)	Yes	20	55.5
Type of meniscus tear	Medial Meniscal tear	11	30.5
	Lateral Meniscal tear	6	16.6
	Both Meniscal tear	3	8.3

Table 5: Osseous injury among patients who underwent Knee MRI at TASH and SPHMMC, from March 2019 to March 2021 G.C (N=209).

Variables	Category	Frequency	Percentage
Osseous Injury(n=36)	Yes	18	50
Bone contusion	Yes	16	44.4
Type of contusion	PLTP	9	25
	MPLFC	12	33.3
	Anterior tibia	1	2.7
	Anterior femoral condyle	1	2.7
Avulsion injury	Yes	5	13.9
Which Avulsion	AMTS	3	8.3
	Lateral tibial rim	2	5.4
ACL Avulsion fracture	Yes	3	8.3
Attachment avulsed	Tibial eminence	3	8.3
ACL tibial avulsion (Meyers and McKeever) grading	Type1	1	2.7
	Type2	1	2.7
	Type 3	1	2.7
	Type 4	0	0

Table 6: Distribution of ACL tears among sex and age and occupation among patients who underwent Knee MRI at TASH and SPHMMC, from March 2019 to March 2021 G.C (N=209).

		ACL TEAR	
		Yes	No
Sex	Male	21	94
	Female	15	79

Age	</= 25	13	50
	25-34	10	38
	35-44	4	34
	>=45	9	51
Occupation	Student	9	35
	Gov't Employee	2	45
	Merchant	4	16
History of trauma	Yes	33	49
	No	3	124

Factors Associated with ACL tear

This study tried to assess some factors which have association with ACL tear. By using binary logistic regression we tried to assess the relationship b/n variables and ACL tear as depicted in table below. Those patients who have History of trauma to knee were 21 times more likely to have ACL tear compared to those who have no history of trauma.

Table 7: Association of ACL tears with sex, age and history of trauma among patients who underwent Knee MRI at TASH and SPHMMC, from March 2019 to March 2021 G.C (N=209).

Variable	**Category**	**ACL TEAR**		**COR, 95% CI**	**AOR 95% CI**	**P-Value**
		Yes	No			
Sex	Male	21(18.3)	94(81.7)	1.17(0.56, 2.43)	0.61(0.25, 1.47)	0.275
	Female	15(16)	79(84)	1		
Age	</= 25	13(20.6)	50(79.4)	1		
	25-34	10(20.8)	38(79.2)	1.01(0.40,2.55)	0.82,(0.27, 2.47)	0.733
	35-44	4(10.5)	34(89.5)	0.45(0.13, 1.50)	0.34(0.08, 1.31)	0.119

	>/=45	9(15)	51(85)	0.67(0.26, 1.72)	0.67(0.22, 2.01)	0.480
Hx of Trauma	Yes	33(40.2)	49(59.8)	27.8(8.1, 94.9)	21.7(9.04, 111.3)	0.001
	No	3(2.4)	124(97.6)	1		

COR; Crude Odd Ratio, AOR: Adjusted odd ratio

5. DISCUSSION

This study showed that 36(17.2%) people out of 209 study participants have anterior cruciate ligament tear. The finding from this study is comparable with the study conducted at Saudi Arabia which showed prevalence of 14.5%. Consequently partial ACL and Complete ACL tear accounts for 44.4% and 55.6%. But study from Saud-Arabia showed partial ACL tear and complete ACL tear accounts for 68.9% and 31.1 % respectively (12).However the finding from this study is high compared to the study from Newzeland, and Australia which showed the prevalence of 0.04% and 0.05%(14, 18).This discrepancy might be attributed to the difference in study population and the variation in sample size between the study since the current study included small study participant compared to those study at Newzeland and Australia. . In addition, the variety between study populations may also contribute for the difference in the prevalence of ACL tear.

Of the partial ACL tear from TASH, 66.7% involved posterolateral bundle while anteromedial bundle are torn in 33.3% (2/6). This finding is comparable with the study conducted at Republic

of Korea which showed prevalence of posterolateral bundle tear 57% (4/7) and anteromedial bundle tear 43% (22).

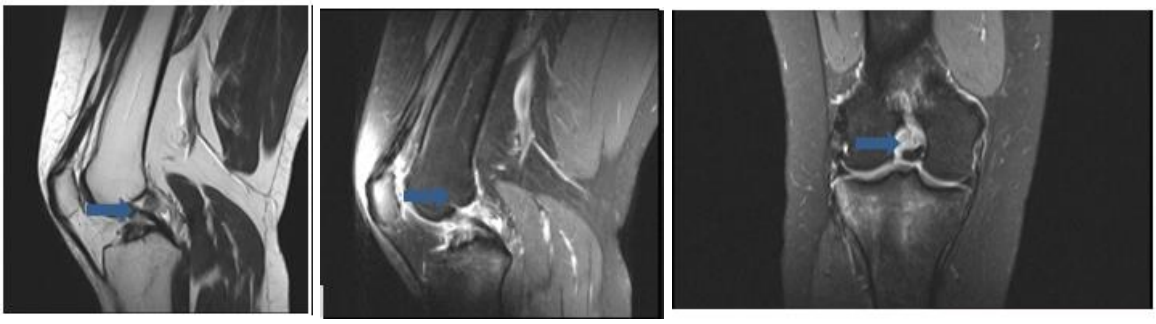

Fig 3: Complete acute ACL tear in 38 year old female patient who presented knee swelling and inability to walk after sustaining falling down accident, Sagittal T2 and PD FS as well as coronal PD FS sequences of the right knee MRI showed non visualization of the ACL on T2 (arrow) and abnormally high signal intensity along the course of ACL on sagittal PD sequence and empty note sign seen on coronal imaging. There is also associated bone marrow edema involving the mid femoral condyle and poster lateral tibia plateau.

Males were commonly affected in our study (58.3%) compared with females (41.7%). Even if the numbers are not comparable males were seen to be more affected in other studies from Saudi Arabia (91.9%) and from India(90.3%) (12,16). Male patient more commonly prone to the ACL tear by 1.17 times but no statistically significant association observed with P-value 0.275.

In addition ACL tear is more common on those whose ages are less than 25 years followed by 25-34 age groups. This finding is also comparable with the study from India that indicated Patients falling in the age group of 16-25 years of age are more prone to have ACL injuries(16). This is attributed to that those young individuals are high level activity age groups which might predispose to falling accident as well as those age groups mainly involve in sporting activity which are the causes for ACL injury. There is no also statistically significant association observed between the age of the patient and ACL tear.

This study showed that right and left knee were equally affected which is comparable with the study from India that indicated some minimal difference that 40% of the patients were affected on the left side, 59% on right side, and 1% on both the sided of the knees(16).

Joint effusion (80.6%) is one of the commonest MRI finding in a patient with ACL tear in our study followed by increased signal intensity on fluid sensitive sequences and fiber discontinuity. This finding is comparable with the study done at University of Cincinnati which showed joint effusion the commonest MRI finding accounting for 84% (24).

Knee pain is the most common clinical presentation in patients who had ACL injury (89%) followed by knee swelling (45.9%). This finding is comparable with the study conducted in India that indicated knee pain is the commonest clinical presentation (91.15%) (23).

The major cause of ACL injury is falling down accident followed by twisting, sport activity and road traffic accident. However, the study from the Saudi Arabia showed ACL tear were common in those who participate in the sport activity (12). This discrepancy might be attributed that the sport investment in our country is not well developed like the others countries.

Meniscal injury is the commonest injury associated with ACL tears (55.5%) of which medial and lateral meniscal tear accounts 30.5% and 16.6% respectively. This finding is consistent with the study conducted at Catholic University of Korea that indicated meniscal tear was one of the common injury associated with ACL tear accounting for 46%(25). There is also another study conducted at Chicago, that is comparable with our finding, indicating injury of the meniscus associated with ACL tear are medial meniscal tear and lateral meniscal tear which accounts 20.9% and 15.6% respectively (17).

Fig 4: Bucket handle medial meniscal tear in a 29 year old male patient who sustained trauma to his leg while playing football, Sagittal PD sequence of the knee MRI showed medial meniscus intrasubstance abnormally increased signal intensity and discontinuous as well as diminutive the body of the meniscus with excess meniscal tissue at intercondylar fossa parallel to the Sagittal plane simulating the double PCL sign (arrow).

Osseous injuries are also seen in 50% of cases with ACL tear of which 13.9% have Avulsion fracture. Anterior tibial spine is injured in 66.7% and segond fracture seen in 33.3%. This finding is comparable to the study from Stanford medical center that showed 5% of ACL injuries, may have avulsion fracture (18).

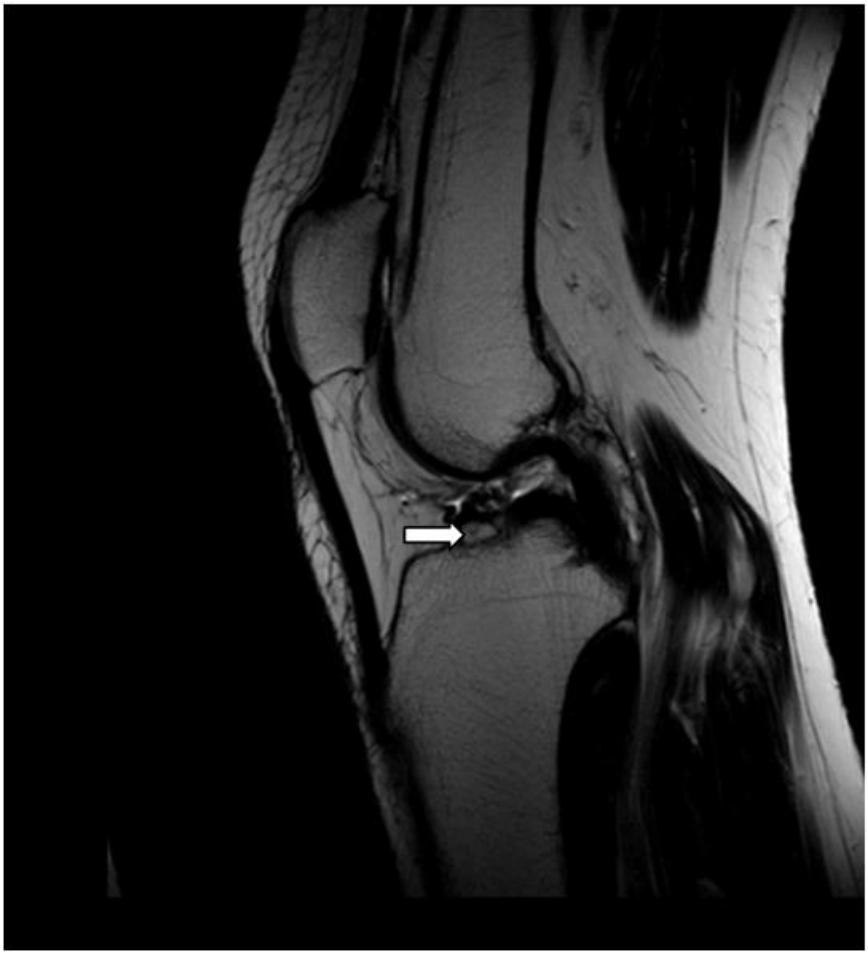

Fig 5: Tibial eminence avulsion fracture in a 37 year old female patient who sustained falling down accident, Sagittal T2 sequence of the knee MRI showed (a) avulsion with complete proximal displacement involving small part of the tibial eminence at the insertion site of ACL (Type 3).

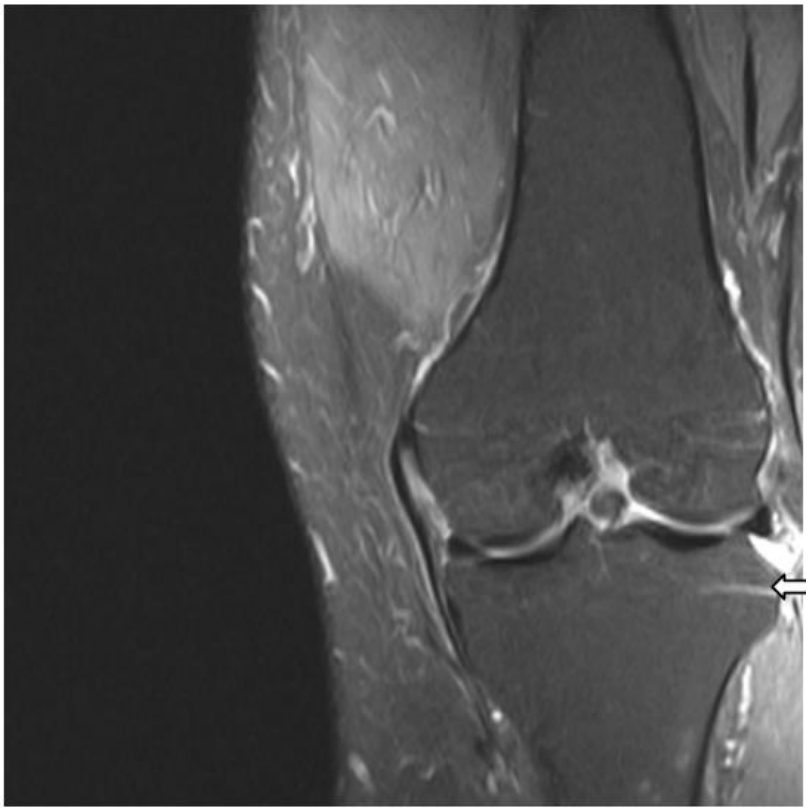

Fig 6: segond fracture in a 45 year old male patient who sustained road traffic accident, Coronal PD FS sequence of the knee MRI showed (a) linear hyper intensity (arrow) breaching the cortex along the lateral border of the lateral tibial plateau with surrounding soft tissue edema.

Posterior cruciate ligament injury and Medial collateral ligament injury are also seen in 8.3%, 19.4% of patients with ACL injury respectively which is comparable with the study from Saudi Arabia which showed the prevalence of PCL and medial collateral ligament injury as 8.1%, 27% respectively(12).

Fig 7: Medial collateral ligament partial tear in 38 year old female patient who sustained falling down accident, Coronal PD FS sequence of the right knee MRI showed abnormally increased signal intensity at femoral attachment of MCL involving the deep fibers (the anterior attachment is spared, not shown here)

Furthermore, our study showed that 5.5% of patients who have ACL tear have an associated postero lateral corner injury. However, the study conducted in Brazil and France showed that the prevalence of posterolateral corner injury in a patient with ACL tear was 19.7% (26). The relatively low rate of concomitant injuries to the PLC reported in our study might be attributed to under-reporting and missed diagnoses. Although PLC injury is a well-known entity, it is surprisingly frequently missed, probably because of a poor understanding of the complex anatomy of this region.

6. Conclusion and Recommendation

Anterior cruciate ligament is one of the commonly injured ligaments. The prevalence of ACL tear is high among males and younger individuals. Patient with ACL tear mainly presented with knee pain and swelling. Joint effusion, abnormal signal intensity and fiber discontinuity are major MRI findings of the ACL tear. Falling down accident is the major cause of knee injury identified. Meniscal tear and osseous injuries are commonly associated with ACL injury with the medial meniscus being the commonly affected one. PCL injury and posterolateral corner injuries may also be associated with ACL tear.

Whenever there is ACL injury evaluation for presence and pattern of any other injury in the knee joint is advised.

A broader and population based study is advised to know the pattern of ACL injury and associated injuries in Ethiopia.

Unlike what was written in literatures falling down accident is one of the common causes of ACL tear which may be a clue for change in epidemiology in developing countries and needs further study on the causes of ACL tear.

It is better to give consideration during exercise and intensive work to prevent ACL tear that result due to falling down.

7. Limitations of the study

More than half of the data was collected from the MR image reports which were done by different radiologists with different level of experience on a knee MRI reporting. Thus this may affect the data quality.

The number of sample size is relatively small.

Incomplete Patient data documentation and inaccessibility of some MRI images on PACS system.

The study is totally dependent on MRI findings and it lacks intraoperative finding or arthroscopy confirmation.

The strength of this study, there is no published study regarding this topic and this study service as baseline to conduct research in our country.

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9. Conflict of interest

The Author declared there is no conflict of interest in this research.

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QUESTIONNAIRE

S. No	Variables	
01	Patient's ID	_____
02	When was the image taken (write date in G.C)	1. From March 01, 2019 to March 01, 2020 2. From March 02, 2020 to March 2021.
03	Sex	1. Male 2. Female
04	Age	_____
05	Occupation	1. Gov't employee 2. Sports men 3. Car driver 4. Merchant 5. Farmer 6. Student 7. Others
06	Where the MRI taken from?	1. TASH 2. SPHMMC
07	To which knee the MRI belongs?	1. Right knee 2. Left knee
08	Is the patient had recent history of trauma?	1. Yes 2. No
09	What is the clinical presentation? (More than one answer is possible)	1. Knee pain 2. Knee swelling 3. Inability to walk 4. Not known, specify the reason 5. Other specify
10	What is the cause of injury?	1. Sport activity 2. Road traffic accident 3. Falling down accident

		4. Twisting injury 5. Stick injury 6. Not known, specify the reason 7. Other specify
11	Is there tear to anterior Cruciate ligament?	1. Yes 2. No
12	If your answer is yes to question no. 11, which side is torn?	1. Right knee ACL 2. Left knee ACL 3. Both
13	If the answer is "yes" to number 12 question what are the MRI findings? (Primary signs) (more than one answer is possible)	1. Swelling 2. Increase signal on T2/PD 3. Fiber discontinuity 4. Empty notch sign 5. Abnormal orientation to blumensaat's line 6. Others specify
14	What are MRI findings? (Secondary signs) (more than one answer is possible)	1. Uncovered lateral meniscus 2. Anterior tibial translocation Sign 3. Positive PCL line sign 4. Angulation of the PCL 5. Jointeffusion/hemarthrosis/lipoarthrosis 6. Others
15	What is the type of ACL tear	1. Acute complete 2. Acute low-grade partial 3. Acute high-grade partial 4. Chronic partial 5. Chronic complete
16	If the ACL tear is partial, which bundle is injured?	1. Anteromedial 2. Posterolateral 3. Unknown
17	Is there any associated injury with	1. Yes

	the ACL tear?	2. No
18	If your answer is “yes” to question no. 17 answer the following questions.	
18.1	Is there any associated ligamentous injury?	1. Yes 2. No
18.1.1	If your answer is yes to question no. 18.1 which ligament is injured? (more than one answer is possible)	1. Medial collateral ligament injury 2. Posterior Cruciate ligament injury 3. Posterolateral corner injuries
18.1.2.1	Is there Posterolateral corner injury?	1. Yes 2. No 3. Unknown
18.1.2.2	If your answer is yes to question no. 18.1.2.1 which component is injured? (more than one answer is possible)	1. Popliteus tendon 2. fibular collateral ligament 3. popliteofibular ligament 4. others
18.1.2.3	What is the grade of Posterolateral corner injury?	1. Low grade 2. High grade
18.1.3.1	Is there Posterior Cruciate ligament injury?	1. Yes 2. No
18.1.3.2	If your answer is yes to question no. 18.1.3.2 write type of injury?	1. Partial tear 2. Complete tear
18.2	Is there any associated meniscal tear?	1. Yes 2. No
18.2.1	If your answer is yes to question no. 18.2, which meniscus is torn?	1. Medial meniscal tear 2. Lateral meniscal tear 3. Both meniscal tear
18.2.2	Specify the type of meniscal tear	1. Horizontal 2. Vertical 3. Radial 4. Bucket handle 5. Flap

		6. Others
18.3	Is there any associated osseous injury?	1. Yes 2. No
18.4	If your answer is "yes" to question no. 18.3 answer the following questions.	
18.4.1	Is there any bone contusion?	1. Yes 2. No
18.4.1.1	If your answer is yes to question no. 18.4.1, which avulsion injury? (more than one answer is possible)	1. Posterolateral tibial plateau 2. mid part of lateral femoral condyle 3. anterior tibia 4. anterior femoral condyle 5. medial tibial plateau 6. Other specify if any
18.4.2	Is there any avulsion injury?	1. Yes 2. No
18.4.2.1	If your answer is yes to question no. 18.4.2, which avulsion injury? (more than one answer is possible)	1. Anterior medial tibial spine 2. Posterior aspect of tibial plateau 3. Medial femoral condyle 4. Proximal medial tibial (reverse Segond) 5. Lateral tibial rim (Segond injury) 6. Tip of fibular head (styloid) 7. Head of the fibula 8. Other specify
18.4.2.1	Is there ACL avulsion fracture?	1. Yes 2. No
18.4.2.1.1	If your answer is yes to question no. 18.4.2.1, which attachment site is avulsed?	1. Femoral 2. Tibial eminence
18.4.2.1.2	If there is ACL tibial avulsion fracture grades it according to	1. **type 1:** minimally/nondisplaced fragment 2. **type 2:** anterior elevation of the fragment

	Meyers and McKeever system.	3. **type 3:** complete separation of the fragment 4. **type 4:** comminuted avulsion or rotation of the fracture fragment