



Original Article

Anterior cruciate ligament tear and associated ligamentous and meniscal injuries - A magnetic resonance imaging-based study in a tertiary care centre in South Kerala

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ABSTRACT

Introduction: The knee joint, being the largest synovial joint in the body, is highly susceptible to musculoskeletal pain and injury, frequently resulting in instability and range-of-motion limitations. The anterior cruciate ligament (ACL) is a crucial stabilizer, preventing the anterior translation of the tibia on the femur, and is commonly injured in athletes and trauma patients. Injuries to the ACL are often immediately disabling, require prolonged rehabilitation, and are frequently associated with trauma to the menisci (MM and LM) and other ligamentous structures. Magnetic Resonance (MR) imaging is the investigation of choice for assessing the status of the ACL and associated structures, as it helps identify subtle meniscal and ligamentous changes necessary for appropriate early management.

Aim: The aim of this study was to identify the association of ACL tear with ligamentous and meniscal injuries of the knee joint based on magnetic resonance imaging findings in a tertiary care centre in South Kerala.

Materials and methods: This was a cross-sectional study conducted in the Department of Radio diagnosis at a tertiary care centre in South Kerala from February 2020 to October 2021. The study population consisted of 79 patients, aged 18 to 40 years, of both genders, referred for MR imaging due to clinical suspicion of an ACL tear. Patients with contraindications for MRI, prior knee surgery, or infective arthritis were excluded. Data was collected using consecutive sampling, and radiological findings were studied from images obtained via a 1.5 Tesla MRI equipment. Statistical analysis involved presenting categorical data as frequency and percentages, continuous data using descriptive statistics (including mean and standard deviation), and associated injury frequencies with percentages and 95% confidence intervals.

Results: The study included 79 participants, 64.6% of whom were male, with a mean age of 28.75 ± 7.12 years. Partial ACL tears were found in 59.5% of cases, while complete tears accounted for 40.5%. Associated medial meniscal (MM) tears were observed in 68.4% of the participants. The most frequent MM injury patterns were posterior horn tear (30.4%) and posterior horn tear with body tear (22.8%). Lateral meniscal (LM) tears were found in 36.7% of the study population, with posterior horn tear being the most common specific pattern (11.4%). Regarding collateral ligaments, 21.6% had a medial collateral ligament (MCL) tear (20.3% partial), 7.6% had a lateral collateral ligament (LCL) tear, and 6.3% had a partial posterior cruciate ligament (PCL) tear. Meniscal injuries were notably more common than collateral ligament injuries.

Conclusion: A significant association was found between ACL tears and other

concurrent ligamentous and meniscal injuries, with meniscal tears occurring much more frequently than collateral ligament injuries. Given the high prevalence of associated injuries (particularly MM tears), a comprehensive clinical and radiological assessment using MRI is crucial for practitioners to enhance prognosis and prevent overlooked injuries that may lead to delayed recovery or re-surgery.

Keywords: Anterior Cruciate Ligament (ACL), Meniscal Tears, Knee Injuries, Magnetic Resonance Imaging (MRI), Ligamentous Injuries.

INTRODUCTION

The knee joint is the largest synovial joint and the most common site of musculoskeletal pain, leading to instability and range-of-motion limitations. Key components include the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial meniscus (MM), and lateral meniscus (LM). Sports-related knee injuries frequently involve meniscal and ligamentous pathologies, necessitating accurate identification for effective care.¹

The ACL plays a vital role in stabilizing the knee, specifically by preventing the anterior translation of the tibia on the femur, and is frequently injured in athletes and trauma patients. ACL tear is a commonly sustained injury, often occurring in association with meniscal tears and trauma to other ligamentous structures around the knee. These associated injuries are immediately disabling and often require a prolonged period of rehabilitation.²

Magnetic Resonance imaging (MRI) has emerged as the investigation of choice to assess the condition of the ACL and other associated structures around the knee. Proper evaluation is essential for identifying even subtle changes, ensuring the patient receives appropriate early management, and avoiding the overlooking of meniscal and ligamentous injuries.³

Since injuries to these structures can result in functional impairment and disability, research into knee joint injuries is necessary. Previous studies focusing on the evaluation of ACL injuries and associated meniscal and ligamentous damage using MRI are scarce in the population of South Kerala. Given that MRI is routinely performed in patients with clinical suspicion of ACL tear, this study aimed to explore the association of ligamentous injuries and meniscal tears in this specific population without additional radiation harm or expense.

METHODS

This was a Cross sectional study conducted in the Department of Radio diagnosis at Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla, Kerala, India. The study period spanned during the period of February 2020 to October 2021.

The study population included patients referred to the department of radio diagnosis for magnetic resonance imaging due to a clinical suspicion of an ACL tear. The sample size was calculated based on the proportion of ACL tear associated lateral meniscus injury from a Tayeb, A. M et al study⁴ with confidence level (1- α) as 95%, absolute precision (d) as 10%.

Inclusion criteria were patients of both genders aged 18 to 40 years who underwent MR imaging for knee injuries and provided consent. Exclusion criteria included patients with contraindication for MRI, those unwilling to consent, previously operated patients for knee injuries, and those with infective arthritis of the knee joint.

Study tools included a patient consent form, a self-prepared proforma for data collection, a patient information sheet, and images obtained from a 1.5 Tesla MRI equipment (G.E) used at the institute. Data collection involved explaining the study purpose, taking informed written consent, and recording the radiological findings of ligamentous and meniscal injuries from the MRI scan into a proforma. Consecutive sampling was used until the required sample size was reached.

The data analysis plan specified that the data would be analysed and presented as frequency and percentages for categorical data and descriptive statistics for continuous data. The frequency of ACL tear associated injuries was presented as percentage and 95% confidence interval.

RESULTS

79 participants, 51 were male (64.6%) and 28 were female (35.4%). The mean age was 28.75 years (SD \pm 7.121), with age ranging from 15 to 40 years. The majority of participants fell into the 21-30 age group were 43% and the 31-40 age group had 41.8%.

The incidence of partial ACL tear was 59.5% (n=47), while complete tear was 40.5% (n=32). A significant proportion of the study population (68.4%) had an associated medial meniscal (MM) tear. The most common MM injury patterns were the posterior horn tear (30.4%) and posterior horn tear with body tear (22.8%). The incidence of associated lateral meniscal (LM) injuries was found to be 36.7%. Posterior horn tear was the most frequent specific LM injury, occurring in 11.4% of cases.

Among collateral ligaments, 17 participants (21.6%) had a medial collateral ligament (MCL) tear, with the vast majority being partial tears (20.3%). Only one participant (1.3%) had a complete MCL tear. Lateral collateral ligament (LCL) tear was observed in 7.6% (n=6) of participants, consisting of 4 partial tears and 2 complete tears. Posterior cruciate ligament (PCL) tear was the least frequent associated injury, found in 6.3% (n=5) of participants, all of which were partial tears. When comparing the type of meniscal injury with the type of ACL tear, injuries like posterior horn tear with body tear (55.6% complete ACL tear), anterior horn tear with posterior horn tear and body tear (57.1% complete ACL tear), and tear of the body (50.0% complete ACL tear) were the types of medial meniscal injuries associated with a higher proportion of complete ACL tear compared to other types.

DISCUSSION

This cross-sectional observational study sought to associate the incidence of ligamentous and meniscal tears with ACL injury in patients at a tertiary care facility in South Kerala. The knee joint's stability depends heavily on the interaction of its supporting structures, and ACL tears are one of the most frequently encountered injuries.

The study population was predominantly male (around 65%) and within the young adult age group (mean age 28.75 years), findings consistent with several other studies, often attributed to higher male involvement in sports activities associated with injuries.^{5, 6}

A crucial aspect of this study was the high prevalence of associated meniscal tears 68.4% for the medial meniscus (MM) and 36.7% for the lateral meniscus (LM). This finding confirms the known propensity for ACL tears to co-occur with meniscal injuries. Importantly, the study observed that meniscal injuries were much commoner than collateral ligament injuries. This high MM tear rate (compared to LM) aligns with some existing literature which suggests that MM tears are more commonly seen in patients with chronic ACL insufficiency. The anatomical reason for the higher MM injury rate is believed to be the MM's stronger connection to the joint capsule and deep medial collateral ligament fibres, making it more stable than the lateral meniscus.^{7, 8}

Collateral ligament injuries were less frequent, with MCL tears in 21.6% and LCL tears in 7.6%. PCL injuries were the least common, observed in only 6.3% of patients. The low PCL injury rate is often reported in literature, possibly due to its anatomical protection and buckling effect.^{9, 10}

The study emphasizes that a high percentage of patients with ACL injury have associated pathology. Magnetic resonance imaging (MRI) is vital because it provides an accurate, non-invasive means of visualizing soft tissue structures. Identifying these concurrent injuries on MRI can significantly enhance the prognosis following surgery, as clinical symptoms of associated medial or lateral capsular/ligamentous injury are often subtle and pain/effusion may interfere with the initial clinical evaluation.

CONCLUSION

The anterior cruciate ligament plays a critical role in stabilizing the knee, and its injury is frequently connected with meniscal tears and stress to other ligamentous structures. Magnetic Resonance (MR) imaging is the investigation of choice for evaluating the state of the ACL and surrounding structures.

In the current study of 79 participants, 68.4% had a medial meniscus tear, while 36.7% had a lateral meniscal tear. Collateral ligament injuries were less frequent, with MCL tears found in 21.6% and LCL tears in 8%. PCL tears were the least common at 6%.

The present study revealed that associated ligamentous tears (MM, LM, MCL, LCL, and PCL) occur concurrently with ACL damage, with meniscal injuries being more frequent than collateral ligament injuries. It is crucial that practitioners perform a complete clinical and radiological assessment, utilizing MRI to rule out associated ligamentous injuries, thereby improving patient recovery and avoiding catastrophic costs associated with delayed diagnosis and re-surgery.

REFERENCES:

1. Flandry, F, Hommel, G. Normal anatomy and biomechanics of the knee. *Sports Medicine and Arthroscopy Review*.2011;19(2): 82–92.

2. Kilinc, B. E., Kara, A., Celik, H., Oc, Y, Camur, S. Is anterior cruciate ligament surgery technique important in rehabilitation and activity scores? *Journal of Exercise Rehabilitation*. 2016;12(3):232–237.
3. Stevens, K. J, Drago, J. L. Anterior cruciate ligament tears and associated injuries. *Topics in Magnetic Resonance Imaging: TMRI*. 2006; 17(5):347–362.
4. Tayeb, A. M., Almohammadi, A. A., Hegaze, A. H., Roublah, F., & Althakafi, K. A. Anterior cruciate ligament injury in association with other knee injuries in King Abdul-Aziz University Hospital, Saudi Arabia. *Cureus*, 2020; 12(9), e10240.
5. Huegli RW, Moelleken SMC, Stork A, Bonel HM, Bredella MA, Mecket S, et al. Genanat and Philip FIT, MR imaging of post-traumatic articular cartilage injuries confined to the femoral trochleass Arthroscopic correlation and clinical significance. *Euro J Radiol*. 2005; 53:90-5.
6. Bin Abd Razak, H. R., Sayampanathan, A. A., Koh, T.-H. B., & Tan, H.-C. A. (2015). Diagnosis of ligamentous and meniscal pathologies in patients with anterior cruciate ligament injury: comparison of magnetic resonance imaging and arthroscopic findings. *Annals of Translational Medicine*, 3(17), 243.
7. Prince, J. S., Laor, T., & Bean, J. A. (2005). MRI of anterior cruciate ligament injuries and associated findings in the pediatric knee: changes with skeletal maturation. *AJR. American Journal of Roentgenology*, 185(3), 756–762.
8. Remer EM, Fitzgerald SW, Friedman H, et al. Anterior cruciate ligament injury: MR imaging diagnosis and patterns of injury. *RadioGraphics* 1992; 12:901-915
9. Ahn J, Choi B, Lee YS, Lee KW, Lee JW, Lee BK. The mechanism and cause of anterior cruciate ligament tear in the Korean military environment. *Knee Surg Relat Res* 2019;31(1):13
10. Cullison TR, O'Brien TJ, Getka K, Jonson S. Anterior cruciate ligament reconstruction in the military patient. *Mil Med* 1998;163:17-9.