Original Article

Pattern of Meniscal Tear in Patients with Anterior Cruciate Ligament Injury at a Rural Tertiary Care Center of Central India: A Prospective Study

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Abstract

Background: Various studies have reported the incidence of meniscal injuries in anterior cruciate ligament (ACL)-deficient knee. It is responsible for the development and progression of knee osteoarthritis (OA) in patients with ACL injury and concomitant meniscal tear. **Objective:** The objective of this study is to find out an occurrence of meniscal tear and its pattern in patients with ACL injury. **Materials and Methods:** We studied 124 patients diagnosed with ACL injury by arthroscopy at a rural tertiary care center of Central India region. The study was conducted from July 2016 to June 2018. Standard protocol was used to collect information for sociodemographic characteristics. Condition of the injury was assessed at the time of arthroscopic procedure and noted. Data were collected and analyzed by Epi Info software. **Results:** We diagnosed 124 patients with ACL injury, out of which 106 (85.5%) were male and 18 were female (14.5%). The mean age of the patients was found to be 28.7 years (±10.7), with a range of 14–59 years. The present study observed the incidence of medial meniscus tear in 30 (24.2%) and lateral meniscal tear in 18 (14.5%) study participants. **Conclusion:** The present study showed a substantial number of cases with meniscal damage. Hence, it is imperative to screen patients with ACL tear clinically and radiologically and even during arthroscopic procedure so that chances of OA association can be minimized by early intervention.

Keywords: Anterior cruciate ligaments, menisci, osteoarthritis

Introduction

The knee joint is prone to trauma resulting in degeneration. Every structure is vital and has a specific role. The anterior cruciate ligament (ACL) is a key ligamentous structure guiding rotation in the normal knee joint. Its disruption changes the ability of the knee joint to maintain stability during rotational, accelerative, and decelerative activities. In the USA alone, over 200,000 ACL injuries occur per year.

Apart from ACL, menisci are also important and play a key role in shock absorption, joint stabilization, and possibly proprioception.[1,2] At least 70%–90% of the axial load transmitted through each compartment is dissipated by its meniscus and affords the protection of articular cartilage from injury.[3] Reid *et al*.[4] suggested that squatting, kneeling, crawling, chair sitting while driving, stair climbing, lifting items, and walking are all risk factors for meniscal tears.

Noyes and Barber-Westin observed an incidence of 65% of meniscal injuries to be associated with ACL injury.[5] Moreover, elapsed time between ACL injury and reconstruction surgery

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has been identified as a risk factor for meniscal tears in multiple studies. Pathologic mechanism suggested that ACL 2injury leads to knee laxity and potentially unstable knee that 3is more susceptible to meniscal injury during dynamic abrupt movements.[6,7]

Magnussen *et al*. documented the development and progression of knee osteoarthritis (OA) in patients with ACL injury and concomitant meniscal tear. And even worse patient-reported outcomes were observed after ACL reconstruction, especially if a partial or total meniscectomy is performed.[8]

This observation has led to efforts to preserve as much meniscal tissue as possible, and meniscus repair combined with ACL reconstruction is increasingly preferred over meniscectomy.[9]

Most of the evidence of meniscal injuries associated with ACL tear are from high-income countries. Although meniscal injury is of paramount importance, very few studies have been done in developing or middle-to-low-income countries. Moreover, from rural areas, they are barely countable; hence, we planned this study to find out the occurrence and pattern of meniscal injury in ACL tear.

Materials and Methods

Study design

We prospectively followed the patients with ACL injury and undergoing arthroscopic ACL reconstruction. The present study was conducted at a tertiary care teaching institute of central India region.

Study duration

The duration of the present study was from July 2013 to June 2018.

Sampling method

We used nonprobability convenient sampling while selecting the participants.

Selection of participants

The following inclusion and exclusion criteria were employed for the selection of participants.

Inclusion criteria

- All patients with a confirmed diagnosis of ACL injury
- Willing to participate and providing consent.

Exclusion criteria

- Concomitant and associated bony injury
- Previous trauma to ipsilateral knee; a history of surgery on ipsilateral knee
- Revision ACL reconstruction; skeletally immature patients
- Refusing to participate in the study.

Out of 153 patients admitted with ACL injury, 12 had associated bony injury and 9 had a previous history of trauma or a history of surgery. We could not follow eight patients; hence, we analyzed the records of 124 patients.

Prior to the start of study, institutional ethical clearance was sought. Informed consent was obtained from the study participants after explaining the study protocol.

The operative procedure comprised examination under regional or combined regional and general anesthesia followed by arthroscopic single-bundle ACL reconstruction using semi-tendonosis and gracilis grafts.

The research fellow recorded all intraoperative findings pertaining to the condition of ligaments, menisci, and articular cartilage as judged by a senior surgeon at the time of index surgery. A senior arthroscopy surgeon performed all procedures. Meniscal lesions on the medial or lateral side were classified at the time of arthroscopy as bucket handle, longitudinal, horizontal, complex, radial, and complete flap tear.

If more than one lesion was identified at a single anatomical location, only the most severe one was included.

The following specific tests were performed for diagnosing ACL insufficiency:

Lachman test

The test is performed by holding the knee in full extension and at 30° flexion and slightly externally rotated. As in the drawer test, besides the amount of anterior dislocation, the quality of the endpoint is important: a soft stop is highly predictive of ACL rupture, whereas a hard stop can indicate an intact ACL, even in case of a sensible amount of tibial translation.[10]

Anterior drawer test

In this test, with the patient in the supine position, the hip and knee are flexed to 45° and 90°, respectively. While the foot was stabilized on the examination table and the hamstrings were relaxed, frequent, manual gentle anterior–posterior forces were applied to the proximal tibia, and tibial anterior–posterior displacement in flexed knee was measured. The degree of displacement was compared with the normal side. Displacement of more than 6 mm comparing the opposite side with a soft end point was proposed as torn ACL.[10]

Pivot-shift maneuver

Here, the patient is in supine position. The clinician fully extends and internally rotates the patient's knee. The clinician's distal hand is placed at the patient's ankle to maintain internal rotation, while his other hand palpates the lateral tibial plateau while inducing slight valgus stress on the knee. The clinician then slowly flexes the knee. The test is considered positive if, during the first 30° of flexion, the clinician observes or palpates a subluxation and/or gliding the tibial plateau, significantly different from the unaffected side.[11]

Injuries to the associated structures were assessed by performing the following clinical tests:

Valgus/varus stress test (for collateral ligaments)

The test should be carried out at 30° flexion rather than in full knee extension: by flexing the knee, all tendinous structures and posterior capsule are released allowing to test the medial collateral ligament and lateral collateral ligament (LCL)

isolated. Palpating the joint line with one finger can be useful to determine the amount of opening.[11]

McMurray's test (for menisci and joint line tenderness)

In this test, the knee is flexed while the leg is externally rotated, palpating the joint line with a finger. Then, the knee is slowly extended. The test for lateral meniscus is carried out by internally rotating the leg. Pain or a crackling sound is felt when the condyle engages in the meniscal lesion.[11]

Posterior drawer test (for posterior cruciate ligament)

The supine variation of this examination places the hip at 45° and the knee at 90°. One hand holds the heel and resists knee flexion, while the other palpates the anterior plateau to assess translation with resisted flexion.[11]

Reverse pivot-shift test (for posterolateral complex)

It evokes the same shift as in pivot-shift signs, but for PCL-deficient knees, the lateral tibial plateau subluxes posteriorly when the tibia is stressed in external rotation and valgus and reduces in extension.[11]

We used standardized protocol to collect information about the demographical data; the type of injury along with the mechanism of injury was noted.

Standardized photographic documentation of every diagnostic arthroscopy and of crucial steps of each arthroscopic procedure is mandatory at our institution, and all photographs are archived in a Picture Archiving and Communication System. Therefore, digitalized arthroscopic photographs from the index procedure were available for all patients, which were reviewed by a single observer with extensive experience in arthroscopic knee surgery for confirmation and categorization of the tear. Patients were followed up monthly for 3 consecutive months.

Data were entered and analyzed with Epi Info software (version 3.5.3, CDC, Atlanta.Georgia, US). An essentially descriptive statistical analysis was performed. Frequency and percentage were used for categorical and ordinal variables. Mean, median, range (minimum and maximum values), and standard deviation were used for continuous variables.

Results

We studied 124 patients diagnosed with ACL injury from July 2016 to June 2018. A total of 106 (85.5%) study participants were male and 18 were female (14.5%). The mean age of the patients was 28.7 years (±10.7), with a range of 14–59 years. In our study, 14 (11.2%) participants were professional athletes involved in activities such as kabaddi, long jump, and sprinting.

The most common cause of injury was found to be fall (twisting of knee) in 74 (59.5%) participants, followed by road traffic accident in 50 (40.5%) participants, as shown in Table 1.

The proportion of meniscal injury (medial meniscus and lateral meniscus) was found to be 48 (38.7%). Medial meniscus tear was present in 30 (24.2%) patients, out of which, the most common type of tear was partial-thickness (10 [33.3%]) followed by bucket-handle type tear in 8 (26.6), vertical in 6 (20%), complex in 4 (13.3%), and horizontal tear in 2 (6.6%) patients. In lateral meniscal tear types, the most common tear was partial-thickness (6 [33.3%]) followed by horizontal tear (4 [22.2%]), bucket handle (4 [22.2%]), linear (2 [11.1%]), and oblique tear (2 [11.1%]), as shown in Table 2.

Posterior cruciate ligament tear was noted in 10 (10.1%) patients, medical collateral ligament injury in 6 (4.8%), and LCL injury in 5 (4%) patients, as shown in Table 2.

Table 1: Descriptive characteristics of patients with anterior cruciate ligament injury

Variables	Frequency (%)
Sex	
Male	106 (85.5)
Female	18 (14.5)
Age distribution	
>20	30 (24.2)
20-45	84 (67.8)
>45	10 (8)
Professional athletes	
Yes	14 (11.2)
No	110 (88.8)
Mechanism of trauma	
Sport-related activities	14 (11.3)
Twisting injury during fall	60 (48.4)
Road traffic accident	50 (40.3)

Table 2: Type of meniscal and ligament injuries associated with anterior cruciate ligament injury

Variable	*n* (%)	Men	Women	*P*
Meniscal injury				
Medial meniscus				
Partial thickness	10 (33.3)	8	2	0.62
Bucket handle	8 (26.6)	7	1	0.83
Vertical	6 (20)	6	0	0.76
Complex	4 (13.3)	4	0	0.99
Horizontal	2 (6.6)	2	0	0.99
Total	30	27	3	0.42
No	94	79	15	
Lateral meniscus				
Partial thickness	6 (33.3)	5	1	0.87
Bucket handle	4 (22.2)	3	1	0.94
Horizontal	4 (22.2)	4	0	0.99
Linear	2 (11.1)	2	0	0.99
Oblique	2 (11.1)	1	1	0.15
Total	18	15	3	0.77
No	116	101	15	
Associated ligament injury				
Posterior cruciate ligament	10 (10.1)	7	3	0.14
Medial collateral ligament	6 (4.8)	5	1	0.87
Lateral collateral ligament	5 (4)	4	1	0.9

Table 3: Meniscal tear in patients with anterior cruciate ligament injury as observed by other studies

Author	Number of Participants (*n*)	Study participants	Medial meniscus involvement (%)	Lateral meniscus involvement (%)
Kilcoyne *et al*.[17]	341	Army personnel	20.6	19.3
Hagino *et al*.[20]	552	Patients	10.8	69.3
Ghodadra *et al*.[21]	709	Patients	37	41
Cimino *et al*.[22]	328	Athletes (skiing)	10	13
Jacob and Oommen[23]	129	Patients	19.3	28.7
Present study	124	Patients	24.2	14.5

Discussion

Along with ACL tear, associated menisci tears are rather common. When an ACL tear occurs, the tibia most commonly translates anteriorly with external rotation relative to the femur.[12] Meniscal tears result from entrapment and rotational forces between the tibia and femur and tensile forces result from the attached points with the posterior joint capsular structures and ligaments.[13]

Failure to recognize and treat meniscal tears at the time of ACL reconstruction can have long-term consequences, including accelerated arthritis and instability that can contribute to ACL graft failure.[13]

Descriptive characteristics

We observed male predominance with a male-to-female ratio of 5.9:1. Females have a higher risk of sustaining ACL tears because of various intrinsic risk factors, such as a smaller notch size, higher Q-angles, increased foot pronation, and tibial internal rotation.[14]

Similar results were found by Sarwar *et al*.[15] where male-to-female ratio was 6.5:1. This is mostly because males are actively and predominantly involved in outdoor and sports-related activities in the Indian subcontinent. The mean age of the study participants was 28.7 years (±10.7), with a range of 14–59 years. Similar observations were made by Panigrahi *et al*. while studying bilateral ACL reconstruction. The mean age observed in their study was 30 years, with a range of 18–42 years.[16]

Although sports-related activities remain a prominent cause for knee injuries, in the present study, only 14 (11.2%) participants were involved in sports.

Meniscus injury

The incidence of meniscal injury was found to be 48 (38.7%). Kilcoyne *et al*. noted a similar observation of concomitant meniscal tears in 39.6% of participants who sustained ACL injuries.[17] This finding is consistent with rates in the literature, ranging from 41% to 82%.[18,19]

Among ACL injuries, we observed that 30 (24.2%) cases were associated with medial meniscal tear, whereas 18 (14.5%) had a concomitant lateral meniscal tear. Similar observations were noted in the study by Hagino *et al*., in which medial meniscal tear was identified in 10.8% of the cases [Table 3].[20]

In their study, the authors found more lateral meniscal tear of 69.4% compared to medial meniscal tear while identifying meniscal tear association with ACL injury.[20] Ghodadra *et al*. noted slightly higher incidence of medial and lateral meniscal tears (37% and 40%, respectively) while studying articular and meniscal pathology associated with primary ACL reconstruction [Table 3].[21]

In the present study, we noted partial-thickness tear as the most common type of tear in both medial and lateral meniscal tears accounting for 33.3% each followed by bucket-handle type of tear accounting 26.6% and 20%, respectively. Ghodadra *et al*. refute similar findings where they found partial-thickness tear (31%) as the prime type of tear followed by bucket-handle tear (15%–27%) in acute ACL injury.[21]

Limitation of the study

To extrapolate the results of this study to wider population, we may need multicentric studies with larger sample size to have external validity.

Conclusion

The present study observed that 24.2% of the patients with ACL tear had medial meniscal tear, whereas lateral meniscal tear was seen in 14.5% of the patients. Hence, it is imperative to screen patients with ACL tear clinically and radiologically and even during arthroscopic procedure.

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Conflicts of interest

There are no conflicts of interest.

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