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Clinico-Radiological Evaluation of Knee Injuries Involving Several Ligaments: an Observational Study

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ABSTRACT
The aim of the present study was to assess the clinical and radiological evaluation of multiple ligament injuries of knee. The prospective research was carried out at the Department of Orthopaedics for a duration of 2 years. The research included a total of 100 patients. The research received approval from the Hospital ethics committee and the patients provided their informed permission to participate. Our 100-person research included 80 men and 20 women. The youngest and oldest patients in our research were 19 and 58. The majority of patients were 17-30 years old. The age group >40 has the fewest cases. We averaged 36.4 years old. Most patients were left-sided, 65 (65%) and 35 (35%) were right-sided. Most patients were injured by road traffic accidents (45), followed by sports injuries (30) and falls (25). From 100 cases, type III ACL+posterolateral complex was the most prevalent pattern with 35 instances (35%) while type IV PCL + Posterolateral complex was the least common with 5 cases (5%). Our research found significant results in the Lachman and Anterior drawer tests for the Anterior cruciate ligament ($p<0.05$). Our research found significant P Values (<0.0001) for posterior drawer test, Valgus stress test, Varus stress test and McMurray's. In our research, posterior sag test P value >0.05 was not statistically significant. Lachman's test is more sensitive than anterior drawer for ACL rupture and posterior drawer for PCL damage than posterior sag test relative to MRI. Varus for LCL and McMurray for medial meniscus were more sensitive than others. Our findings indicate that MRI is a superior non-invasive diagnostic method for multiple ligament knee injuries compared to clinical evaluation. MRI offers detailed information about the ligaments implicated and the extent of their involvement and it is also cost-effective.

INTRODUCTION

Multi-ligament knee injuries (MLKIs) are infrequent but significant injuries often resulting from high-impact trauma[1-3]. MLKIs, or multifilament knee injuries, refer to the total rupture of two or more cruciate and/or collateral ligaments, with or without accompanying damage to the meniscus, nerves, arteries, or periarticular fractures[4]. Some individuals with medial collateral knee injuries (MLKIs) may have knee dislocations (KD). However, it is possible for the dislocated knee to spontaneously decrease or be reduced in the emergency room prior to hospitalization. As a result, the severity of the damaged knee may be overestimated[5-6].

Timely identification of damaged structures is essential for the treatment of musculoskeletal limb injuries (MLKIs). Magnetic Resonance Imaging (MRI) is the indispensable preoperative imaging procedure that is also effective for identifying nerve injuries[7]. The diagnostic efficacy of MRI in detecting isolated ligament injuries has been well established. However, when it comes to multi-ligament injuries, the reliability of MRI remains a subject of debate. According to Derby[8], MRI was effective in identifying injuries to the cruciate and collateral ligaments, but it was not dependable in diagnosing meniscus or posterolateral corner (PLC) lesions[9]. Munshi[10] found that MRI had consistent sensitivity and specificity in identifying cruciate ligament damage and meniscal tears, including lesions that were not accurately diagnosed using arthroscopy. Halinen *et al.* and Kosy *et al.* had comparable findings[11-12]. Barbier[13] found that MRI lacks accuracy and consistency in terms of repeatability. Therefore, it is recommended to combine the MRI diagnosis with clinical examination and stress X-rays.

Furthermore, there have been reports indicating that MRI was found to be less effective than clinical evaluation[14]. The term "multi ligament injury" is used when two or more knee stabilizers, such as the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), lateral collateral ligament (LCL), posterolateral corner (PLC), medial collateral ligament (MCL) and posteromedial corner (PMC), are disrupted. Some of these injuries are likely to have resulted in knee dislocation (KD) or significant subluxation[15-17]. The objective of this research was to evaluate the clinical and radiological assessment of knee injuries involving several ligaments.

MATERIALS AND METHODS

The prospective research was carried out at the Department of Orthopaedics for a duration of 2 years. The research included a total of 100 patients. The research received approval from the Hospital ethics committee and the patients provided their informed permission to participate.

Inclusion Criteria:

- Individuals of all genders and age ranges.
- The study comprised individuals between the ages of 17 and 60.
- These individuals had clinical indications and symptoms after an injury, but had not had any prior surgery on the afflicted knee.
- Additionally, they had not incurred any previous damage to the cruciate or collateral ligaments in the affected knee.

Exclusion Criteria:

- Individuals with a solitary ligament injury.
- Patients with widespread ligament laxity.
- Individuals with fractures and complex injuries.
- Patients who are reluctant and resistant to clinical examination.

Statistical Analysis: Data analysis was done using the SPSS (statistical package for the social science) version 17 for windows. The demographic variables, other variables were calculated with number and percentage. A probability value of0.05 was accepted as the level of statistical significance.

RESULTS AND DISCUSSIONS

Table 1: Baseline Characteristics

Gender	N	%
Male	80	80
Female	20	20
Age group in years		
<30	45	45
31-40	30	30
>40	25	25
Site of distribution		
Left	65	65
Right	35	35
Mode of injury		
RTA	45	45
Sports injury	30	30
Fall	25	25

Our 100-person research included 80 men and 20 women. The youngest and oldest patients in our research were 19 and 58. The majority of patients were 17-30 years old. The age group >40 has the fewest cases. We averaged 36.4 years old. Most patients were left-sided, 65 (65%) and 35 (35%) were right-sided. Most patients were injured by road traffic accidents (45), followed by sports injuries (30) and falls (25).

Table 2: Patterns of Ligament Injury

Patterns of ligament injury	N	%
i)ACL+MCL	15	15
ii)ACL+MCL+ Medial Capsule	25	25
iii)ACL+Posterolateral Complex	35	35
iv)PCL+Posterolateral Complex	5	5
v)PCL+MCL+ Medial Capsule	7	7
Others	13	13

In our study out of 100 cases, most common pattern of injury was type III ACL + posterolateral complex with 35 cases (35%) and the least common was type IV PCL+Posterolateral complex with only 5 cases (5%).

Table 3: Association Between Clinical and Radiological Findings of Multiple Ligament Injury in Study Group

Clinical findings		Radiological findings Present	Absent	p-value
Lachman test	Present	76	00	<0.05
	Absent	16	8	
Anterior drawer test	Present	74	00	<0.05
	Absent	16	10	
PCL sag test	Present	8	0	>0.05
	Absent	16	76	
Posterior drawer test	Present	14	0	<0.05
	Absent	6	80	
Valgus stress test	Present	30	0	<0.05
	Absent	10	60	
Varus stress test	Present	22	0	<0.05
	Absent	12	66	
McMurry's test (ER)	Present	28	0	<0.05
	Absent	4	68	
McMurry's test (IR)	Present	12	0	<0.05

Our research found significant results in the Lachman and Anterior drawer tests for the Anterior cruciate ligament (p<0.05). In our research, the posterior drawer test, Valgus stress test, Varus stress test and McMurray's showed significant P Values <0.05. In our research, posterior sag test P value >0.05 was not statistically significant.

Table 4: Sensitivity, Specificity, PPV, NPV, Accuracy of Various Clinical Tests

Clinical findings	Sensitivity	Specificity	PPV	NPV	Accuracy
Lachman's test	82.48	100	100	38.6	82.35
Anterior drawer test	79.73	100	100	34.35	80.00
PCL sag test	28.52	100	100	83.17	84.36
Posterior drawer test	73.47	100	100	93	92.34
Valgus stress test	85.70	100	100	87.88	94.34
Varus stress test	66.24	100	100	81.96	85.65
McMurry's test (ER)	93.67	100	100	93.73	95.65
McMurry's test (IR)	53	100	100	85.65	86.54

Lachman's test is more sensitive than anterior drawer for ACL rupture and posterior drawer for PCL damage than posterior sag test relative to MRI. Varus for LCL and McMurray for medial meniscus were more sensitive than others.

Multiple ligament-injured knees complicate orthopaedic surgery. The knee is one of the most often damaged joints due to its anatomy, external stresses, and functional demands[18]. Our bipedal existence depends on the knee joint, the biggest and most complex in the body. Its location between the skeleton's longest lever arms renders it prone to injury, and substantial component damage causes pain and incapacity[19].

Contact sports including football, skiing, ice hockey, wrestling and gymnastics may damage knee ligaments. Knee ligament tears are prevalent in motorcycle accidents. Running athlete deceleration may potentially induce ligament disruption due to sudden strong loading or twisting without fall or collision[18].

Knee injuries are prevalent. The growing number of clinical tests and knowledge of joint biomechanics makes clinical examination interpretation and sign or test reliance problematic[20]. Our 100-person research included 80 men and 20 women. Due of men's travel and outdoor hobbies, male patients are more common. Our results align with those of Bispo Júnior[21]. The youngest and oldest patients in our research were 19 and 58. The majority of patients were 17-30 years old. The age group >40 has the fewest cases. We averaged 36.4 years old. Age incidence is similar to Halinen J *et al.* (38.6 yr)[22]. Individuals were mostly left-sided, with 65 (65%) and 35 (35%) being right-sided. In Esmaili[23], left-sided injury predominated (57.1). Most patients were injured by road traffic accidents (45), followed by sports injuries (30) and falls (25). Meritt[24] found that 59% of multiple ligament knee injuries were caused by high energy mechanism damage (MVA) and 41% by low energy mechanism injury. From 100 cases, type III ACL+ posterolateral complex was the most prevalent pattern with 35 instances (35%) while type IV PCL + Posterolateral complex was the least common with 5 cases (5%). Kaeding[25] and Meritt[24] found that ACL+MCL was the most prevalent presenting pattern of multiple ligament knee injury, followed by ACL+PLC. Our research found significant results in the Lachman and Anterior drawer tests for the Anterior cruciate ligament (p<0.05). Our research found significant P Values (<0.05) for posterior drawer test, Valgus stress test, Varus stress test and McMurray's. In our research, posterior sag test P value >0.05 was not statistically significant. Lachman's test is more sensitive than anterior drawer for ACL rupture and posterior drawer for PCL damage than posterior sag test relative to MRI. Varus for LCL and McMurray for medial meniscus were more sensitive that others.

CONCLUSION

Our findings indicate that MRI is a superior non-invasive diagnostic method for multiple ligament knee injuries compared to clinical evaluation. MRI offers detailed information about the specific ligaments affected and the severity of the injury, while also being cost-effective.

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