

**A Hospital Based Prospective Clinical and Radiological Assessment of Multiple Ligament Injuries of Knee**Abhinav Kumar<sup>1</sup>, Rahul Harish<sup>2</sup>, Puja Sinha<sup>3</sup><sup>1</sup>Assistant Professor, Department of Orthopaedics, Narayan Medical College & Hospital, Sasaram, Bihar, India<sup>2</sup>Senior Resident, Department of Orthopaedics, Narayan Medical College & Hospital, Sasaram, Bihar, India<sup>3</sup>Medical Officer, CHC, Palkot, Gumla, Jharkhand, India

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Corresponding author: Dr. Rahul Harish

Conflict of interest: Nil

**Abstract****Aim:** The aim of the present study was to assess the clinical and radiological evaluation of multiple ligament injuries of knee.**Methods:** The Prospective study was conducted in the Department of Orthopaedics for the period of 1 year. 50 cases were included in the study.**Results:** In our study out of 50, there were 39 males and 11 females. The youngest and the oldest patient in our study were 18 and 60 years old respectively. Majority of the patients were found to be between the age group of 17-30 years. The least number of cases are found in the age group of >40 years. The average age was 35.5 years. Majority of the patients were of left side, 31 patients (62%) and remaining 19 patients (38%) were of right side. Most common mode of injury was Road Traffic Accidents with 22 patients followed by 16 patients with sports injury and 12 patients with history of fall. In our study out of 50 cases, most common pattern of injury was type III ACL + posterolateral complex with 18 cases (36%) and the least common was type IV PCL +Posterolateral complex with only 2 cases (4%). Lachman test and Anterior drawer test for Anterior cruciate ligament had a P Value <0.05 which was statistically significant in our study. Posterior drawer test, Valgus stress test, Varus stress test, McMurray's had P Value <0.0001 which was statistically highly significant in our study. Posterior sag test had P value >0.05 which had not statistically significant in our study. On comparing with MRI Lachman's test is more sensitive than anterior drawer for ACL tear, For PCL injury posterior drawer was more sensitive than Posterior sag test. Varus test for LCL and McMurray's test for Medial meniscus were more sensitive than their counterparts.**Conclusion:** We concluded that MRI is better non-invasive diagnostic tool for multiple ligament knee injuries than clinical examination which provides with the information of ligaments involved, grade of involvement and is cost effective.**Keywords:** clinical evaluation, radiological evaluation, multiple ligament injuries, kneeThis is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.**Introduction**

Multi-ligament knee injuries (MLKIs) are rare but serious injuries that are usually caused by high-energy trauma. [1-3] The definition of MLKIs is the complete tear of 2 or more cruciate and/or collateral ligaments, with or without injuries of meniscus, nerves, arteries, or periarticular fractures. [4] Some of the MLKIs have knee dislocations (KD), however, the dislocated knee can reduce spontaneously or have been reduced in the emergency department before hospitalization, thus the severity of the injured knee can be underestimated. [1,5,6] Early detection of injured structures is crucial for the management of MLKIs,

MRI is the necessary preoperative imaging examination, which is also valuable in detecting nerve injuries. [7]

The value of MRI for diagnosing isolated ligament injuries has been widely demonstrated, however, in terms of multi-ligament injuries, the accuracy of MRI is controversial. Derby et al [8] found that MRI was sensitive in detecting injuries of cruciate and collateral ligaments, but not reliable in diagnosing injury to the meniscus or posterolateral corner (PLC). Twaddle et al [9] demonstrated that MRI is not reliable for revealing injuries of the lateral collateral ligament (LCL) and PLC. However,

Munshi et al [10] reported that MRI had reliable sensitivity and specificity for detecting cruciate ligament injury and meniscal tears, even injuries that could not be precisely identified by arthroscopy. Similar results were found by Halinen et al [11] and Kosy et al. [12] In terms of reproducibility, Barbier et al [13] demonstrated that MRI lacks precision and reproducibility, and the diagnosis should be integrated with clinical exam and stress X-rays. It has been also reported that MRI was inferior to clinical examination. [14]

When at least two or more of the knee stabilizers are disrupted – anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), lateral collateral ligament (LCL) and posterolateral corner (PLC), and medial collateral ligament (MCL) and posteromedial corner (PMC) – the term multiligament injury is used. Knee dislocation (KD) or substantial subluxation is likely to have occurred in some of these injuries. [15-17] The energy of such injuries varies from high-velocity injuries (road traffic accident), low-velocity injuries (contact sports) to ultra-low-velocity injuries (everyday activities in the obese population). [18,19]

The aim of the present study was to assess the clinical and radiological evaluation of multiple ligament injuries of knee.

**Materials and Methods**

The Prospective study was conducted in the Department of Orthopaedics, Narayan Medical

College & Hospital, Sasaram, Bihar, India for the period of 1 year. 50 cases were included in the study.

**Inclusion Criteria:**

- Patients of both sexes and age groups 17 years to 60 years was included
- Patients with clinical signs and symptoms after injury
- No previous surgery performed on the affected knee
- No previous cruciate or collateral ligament damage sustained in the affected knee

**Exclusion Criteria:**

- Single ligament injury
- Patients with generalized ligament laxity
- Patients with fractures and compound injuries
- Patients who are uncooperative and unwilling for 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. To compare the results of our study with other standard studies we used 'Pearson Chi-Square' test. By using this test we have calculated P value. A probability value of 0.05 was accepted as the level of statistical significance.

**Results**

**Table 1: Baseline characteristics**

Gender	N	%
Male	39	78
Female	11	22
<b>Age group in years</b>		
<30	22	44
31-40	16	32
>40	12	24
<b>Site of distribution</b>		
Left	31	62
Right	19	38
<b>Mode of injury</b>		
RTA	22	44
Sports injury	16	32
Fall	12	24

In our study out of 50, there were 39 males and 11 females. The youngest and the oldest patient in our study were 18 and 60 years old respectively. Majority of the patients were found to be between the age group of 17-30 years. The least number of cases are found in the age group of >40 years. The

average age was 35.5 years. Majority of the patients were of left side, 31 patients (62%) and remaining 19 patients (38%) were of right side. Most common mode of injury was Road Traffic Accidents with 22 patients followed by 16 patients with sports injury and 12 patients with history of fall.

**Table 2: Patterns of ligament injury**

Patterns of ligament injury	N	%
ACL+MCL	8	16
ACL+MCL+MEDIAL CAPSULE	12	24
ACL+POSTEROLATERAL COMPLEX	18	36
PCL+POSTEROLATERAL COMPLEX	2	4
PCL+MCL+MEDIAL CAPSULE	3	6
Others	7	14

In our study out of 50 cases, most common pattern of injury was type III ACL + posterolateral complex with 18 cases (36%) and the least common was type IV PCL +Posterolateral complex with only 2 cases (4%).

**Table 3: Association between clinical and radiological findings of multiple ligament injury in study group**

Clinical findings		Radiological findings		p-value
		Present	Absent	
Lachman test	Present	38	00	<0.05
	Absent	8	4	
Anterior drawer test	Present	37	00	<0.05
	Absent	8	5	
PCL sag test	Present	4	0	>0.05
	Absent	8	38	
Posterior drawer test	Present	7	0	<0.0001
	Absent	3	40	
Valgus stress test	Present	15	0	<0.0001
	Absent	5	30	
Varus stress test	Present	11	0	<0.0001
	Absent	6	33	
McMurry’s test (ER)	Present	14	0	<0.0001
	Absent	2	34	
McMurry’s test (IR)	Present	6	0	<0.0001
	Absent	6	38	

Lachman test and Anterior drawer test for Anterior cruciate ligament had a P Value <0.05 which was statistically significant in our study. Posterior drawer test, Valgus stress test, Varus stress test, McMurray's had P Value <0.0001 which was statistically highly significant in our study. Posterior sag test had P value >0.05 which had not statistically significant in our study.

**Table 4: Sensitivity, specificity, PPV, NPV, accuracy of various clinical tests**

Clinical findings	Sensitivity	Specificity	PPV	NPV	Accuracy
Lachman’s test	81.48	100	100	38.6	82.35
Anterior drawer test	78.76	100	100	34.35	80.00
PCL sag test	29.58	100	100	83.17	84.36
Posterior drawer test	72.44	100	100	93	92.34
Valgus stress test	86.72	100	100	87.88	94.34
Varus stress test	68.22	100	100	81.96	85.65
McMurry’s test (ER)	92.68	100	100	93.73	95.65
McMurry’s test (IR)	52	100	100	85.65	86.54

On comparing with MRI Lachman’s test is more sensitive than anterior drawer for ACL tear, For PCL injury posterior drawer was more sensitive than Posterior sag test. Varus test for LCL and McMurray’s test for Medial meniscus were more sensitive than their counterparts.

**Discussion**

The multiple ligament-injured knee is a complex problem in orthopedic surgery. The knee is one of the most frequently injured joints because of its anatomical structure, its exposure to external forces and the functional demands placed on it. [20] The

knee joint is the largest and probably the most complex joint within the human body its vital importance in support and locomotion of our bipedal existence. Its position between the two longest lever arms of the skeleton makes it vulnerable to injury, damage to its major components results in much discomfort and disability. [21] Knee ligaments are often injured in contact athletic activities such as football, skiing, ice hockey, wrestling and gymnastics can produce enough stress to disrupt knee ligaments. Motor vehicle accidents, especially those involving motorcycles, are common causes of knee ligament disruptions. Sudden severe loading or twisting injury without a fall or contact, like deceleration of a running athlete can also cause ligament disruption. [20]

The knee is a common site of injury. The increasing number of clinical tests and greater understanding of the joints biomechanics, leads to difficulties in both the interpretation of the clinical examination and in the reliance that should be placed on specific signs or tests. [22] In our study out of 50, there were 39 males and 11 females. The high incidence of male patients can be attributed to travelling and outdoor activities which are mainly carried out by men. Our findings are comparable to the studies done by Bispo Júnior RZ et al. [23] The youngest and the oldest patient in our study were 18 and 60 years old respectively. Majority of the patients were found to be between the age group of 17-30 years. The least number of cases are found in the age group of >40 years. The average age was 35.5 years. Age incidence is comparable with the study done previously by Halinen J et al (38.6 yr). [24]

Majority of the patients were of left side, 31 patients (62%) and remaining 19 patients (38%) were of right side. Similarly, in the study done by EsmailiJah AA et al [25] left sided injury was predominant (57.1). Most common mode of injury was Road Traffic Accidents with 22 patients followed by 16 patients with sports injury and 12 patients with history of fall. Similar findings were seen in the study done by Meritt AL et al.<sup>26</sup> where they stated that 59% had high energy mechanism injury (MVA) is the main cause of multiple ligament knee injury followed by 41% low energy mechanism injury. In our study out of 50 cases, most common pattern of injury was type III ACL + posterolateral complex with 18 cases (36%) and the least common was type IV PCL +Posterolateral complex with only 2 cases (4%). In a study by Kaeding C et al [27] and Meritt L et al [26], the most common presenting pattern of multiple ligament knee injury was involving the ACL+MCL and after that ACL+PLC making it the second most common.

Lachman test and Anterior drawer test for Anterior cruciate ligament had a P Value <0.05 which was statistically significant in our study. Posterior drawer test, Valgus stress test, Varus stress test,

McMurray's had P Value <0.0001 which was statistically highly significant in our study. Posterior sag test had P value >0.05 which had not statistically significant in our study. On comparing with MRI Lachman's test is more sensitive than anterior drawer for ACL tear, For PCL injury posterior drawer was more sensitive than Posterior sag test. Varus test for LCL and McMurray's test for Medial meniscus were more sensitive than their counterparts.

### Conclusion

We concluded that MRI is better non-invasive diagnostic tool for multiple ligament knee injuries than clinical examination which provides with the information of ligaments involved, grade of involvement and is cost effective.

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