

FREQUENCY OF THE KNEE POSTEROLATERAL CORNER INJURY IN COMBINATION WITH ANTERIOR CRUCIATE LIGAMENT INJURY

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ABSTRACT

Objective: To determine the frequency of posterolateral corner injury in combination with an anterior cruciate ligament injury.

Materials and Methods: This Descriptive Cross-Sectional study was performed at Ortho Unit, MTI-Khyber Teaching Hospital Peshawar from 18 July 2020 to 18 January 2021. A detailed clinical history was taken followed by a general physical and systemic examination from all patients presenting with diagnosed anterior cruciate ligament tear on MRI. A plain radiograph of the involved knee was taken in sagittal and coronal planes to identify any fracture or dislocations and make necessary exclusions. The finally selected patients were enrolled and a specific data sheet purposely designed, was filled for each of them. A quick height, weight, and BMI (on Stadiometer and standard weighing scale) calculation were done and Beighton score was calculated for all patients.

Results: Incidence of posterolateral corner (PLC) injuries was found in 36 (21.3%) patients combined with anterior cruciate ligament (ACL).

Conclusion: It is of utmost importance to detect and treat the injury properly. As PLC injuries are not usually diagnosed in the first place, therefore, a thorough understanding of functional interactions of the PLC, specific history taking, and precise physical examination are required for the diagnosis and treatment.

Keywords: Anterior Cruciate Ligament (ACL); Posterolateral Corner (PLC); Knee; Multiligamentous Injury

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INTRODUCTION

The knee joint is one of the most commonly injured joints, as an isolated injury or a frequent component in multiple trauma patients. The knee is a complex joint, consisting of two condylar joints between the corresponding condyles of the femur and tibia and a patellar joint between the patella and femur¹. Injuries to the posterolateral corner of the knee occurring in isolation or combination with injuries to the anterior cruciate ligament are uncommon and yet a common cause of ACL reconstruction failure. Posterolateral corner lesions have been estimated to occur in 9.1% of acute knee injuries with haemarthrosis and 16% of all knee ligament injuries². The diagnosis is usually missed at the time of the accident.

The main structures that make up the posterolateral corner of the knee are the lateral collateral ligament, popliteus tendon, popliteal-fibular ligament, and lateral knee capsule. Biomechanical studies have established that injuries to the posterolateral corner of the knee worsen the deleterious effects of tears in one or both cruciate ligaments³. A posterolateral corner injury that is not taken into account in the initial treatment strategy increases the risk of failure of procedures to reconstruct the central knee structures⁴.

The posterolateral corner (PLC) structures interact functionally with the anterior cruciate ligament (ACL). They act as the primary restraint to varus and external rotation. The ACL acts as a secondary restraint to varus angulation. Because of joint conformity of the lateral compartment of the knee and the inherent bony instability of the lateral tibial plateau, injuries of the PLC structures create a set of marked instability⁵. When this is combined with an ACL tear, the instability is frank.

In an ACL-PLC injured knee, an untreated PLC injury causes a significant increase in force on the ACL graft and may be a leading cause of graft failure. So the recon-

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struction should be combined⁶. In the setting of combined ACL-PLC reconstruction procedures, femoral tunnel inter-section has been reported to be high.⁵ The proximity of ACL and lateral collateral ligament tunnels in the lateral femoral condyle carries the risk of bone weakening and tunnel collision and hence compromises graft function⁷⁻¹⁰. We receive plenty of patients will knee traumatic injuries in our department undergoing anterior cruciate ligament reconstruction for ACL tear as well as in some patients posterolateral corner reconstruction. In this study, I will determine the prevalence of posterolateral corner injury in combination with anterior cruciate ligament injuries. This study will help us in finding the frequency of those patients who have posterolateral corner injury using a very simple, cost-effective clinical test. The impact of this study will be to make use of these simple clinical test by medical professionals which normally is not used by them and will overall improve the outcome of ACL reconstruction in terms of identifying a population having neglected posterolateral corner injuries. The study will also act as a reference by scholars and a base for further research.

MATERIALS AND METHODS

This Descriptive Cross-Sectional study was performed at Ortho Unit, MTI-Khyber Teaching Hospital Peshawar from 18 July 2020 to 18 January 2021. A detailed clinical history was taken followed by a general physical and systemic examination from all patients presenting with diagnosed anterior cruciate ligament tear on MRI. A plain radiograph of the involved knee was taken in sagittal and coronal planes to identify any fracture or dislocations and make necessary exclusions. The finally selected patients were enrolled and a specific data sheet purposefully designed, was filled for each of them. A quick height, weight, and BMI (on stadiometer and standard weighing scale) calculation were done and Beighton score was calculated for all patients. The sample size of this study was 169. Calculations are based using a 95% confidence level, 19.6% prevalence of posterolateral corner injury with concomitant anterior cruciate ligament injury⁹. The margin of error was kept 6% under the WHO formula for sample size determination in health Consecutive non-probability sampling. Both male and female patients having a confirmed ACL tear for the last six months in the Age range 16-40 Years were included in the study. However, Patients with Severe synovitis, those with the past history of ipsilateral knee joint surgery, or those with associated fracture of femoral/ tibial condyles and knee joint dislocation or those having evidence of .osteoarthritis either clinically or radiographically were excluded from this study. After securing

permission from the Ethical & Research Approval Committee of our institution. The study was conducted at Department of Orthopedics & Trauma, Khyber Teaching Hospital Peshawar. Patients were selected from outpatient and Emergency departments. The purpose and benefits of the study were explained to all patients included in study. Written informed consent was taken from all patients. A detailed clinical history was taken followed by general physical and systemic examination from all patients presenting with diagnosed anterior cruciate ligament tear on MRI. A plain radiograph of involved knee was taken in sagittal and coronal planes in order to identify any fracture or dislocations and make necessary exclusions. The finally selected patient was enrolled and a specific data sheet purposefully designed was filled for each of them. A quick height, weight, and BMI calculation was done and Beighton score was calculated for all patients.

The patient was then undergo stress radiography of injured and uninjured knee. A bolster was kept below each knee and a 30 degree angle was maintained at knee in flexion. A varus stress was applied while the patient on radiography table and plain anteroposterior radiograph was taken. The same procedure was repeated for the normal knee. A difference of 4mm or more of opening on lateral side of knee between distal femoral condyle and proximal tibia plateau measured on the ruler was considered as having posterolateral corner injury. All procedures was performed by the same final year resident under supervision of consultant orthopedic surgeon. After confirmation of posterolateral corner injury, the frequency of posterolateral corner injury was calculated among the total subjects included in the study. All data was recorded in form of charts and tables. Confounder was controlled by strictly following exclusion criteria. Data was stored and analyzed using statistical software SPSS version 21. All the quantitative variables like age, BMI, time since ACL tear (months) was analyzed by Mean along with standard deviation. Frequencies and percentages were calculated for qualitative variables like gender, type of sports injury (Cricket, Foot Ball, Hockey, Skiing and others), Knee involvement (right or left), and obesity. Posterolateral corner tear was stratified among age, gender, time since ACL tear, right or left side, BMI, type of sport to see effect modifications. Other effect modifier like obesity, ligamentous laxity (Beighton score >4) was controlled through stratification. Post stratification chi square test was applied keeping P value equal or less than 0.05. All the results was presented on tables and graphs.

RESULTS

The study was conducted at the Department of Orthopedics Surgery, Khyber Teaching Hospital Peshawar. Comprehensive results of my study are as under:-

Mean and SDs for age was 25.70 ± 5.128 . Mean and SDs for time since ACL tear was 3.86 ± 1.210 . Mean

Table No 1: Descriptive Statistics of Study (n=169)

Numerical Variables	Minimum	Maximum	Mean	Std. Deviation
Age	16	38	25.70	5.128
Time Since ACL Tear (Months)	2	6	3.86	1.210
Body Mass Index (kg/m ²)	1.00	32.20	26.9172	2.99621
Ligamentous Laxity	2	8	4.54	1.150

Table No 2: Age Wise Distribution (n=169)

Age Groups	Frequency	Percent
16-30 Years	141	83.4%
31-40 Years	28	16.6%
Total	169	100.0%

Table No 3: Gender Wise Distribution (n=169)

Gender Groups	Frequency	Percent
Male	108	63.9%
Female	61	36.1%
Total	169	100.0%

Table No 4: Frequencies and Percentages for Type of Sports Injury (n=169)

Type of Sports Injury	Frequency	Percent
Hockey	56	33.1%
Football	113	66.9%
Total	169	100.0%

Table No 5: Frequencies and Percentages for Knee Involved (n=169)

Knee Involved	Frequency	Percent
Right	78	46.2%
Left	46	27.2%
Bilateral	45	26.6%
Total	169	100.0%

Table No 6: Frequencies and Percentages for Obesity (n=169)

Obesity	Frequency	Percent
Yes	41	24.3%
No	128	75.7%
Total	169	100.0%

Table No 7: Frequencies and Percentages for Posterolateral Corner Injury (n=169)

Posterolateral Corner Injury	Frequency	Percent
Yes	36	21.3%
No	133	78.7%
Total	169	100.0%

Table No 8: Stratification of Posterolateral Corner Injury with Age Groups (n=169)

		Age Groups		P Value 0.134
		16-30 Years	31-40 Years	
Posterolateral Corner Injury	Yes	33	3	
		91.7%	8.3%	
	No	108	25	
		81.2%	18.8%	
Total		141	28	
		83.4%	16.6%	

Table No 9: Stratification of Posterolateral Corner Injury with Gender Groups (n=169)

		Age Groups		Total	P Value
		Male	Female		0.435
Posterolateral Corner Injury	Yes	25	11	36	
		69.4%	30.6%	100.0%	
	No	83	50	133	
		62.4%	37.6%	100.0%	
Total		108	61	169	
		63.9%	36.1%	100.0%	

Table No 10: Stratification of Posterolateral Corner Injury with Type of Sports Injury (n=169)

		Type of Sports Injury		Total	P Value
		Hockey	Foot Ball		0.669
Posterolateral Corner Injury	Yes	13	23	36	
		36.1%	63.9%	100.0%	
	No	43	90	133	
		32.3%	67.7%	100.0%	
Total		56	113	169	
		33.1%	66.9%	100.0%	

Table No 11: Stratification of Posterolateral Corner Injury with Knee Involved (n=169)

		Knee Involved			P Value
		Right	Left	Bilateral	0.815
Posterolateral Corner Injury	Yes	15	11	10	
		41.7%	30.6%	27.8%	
	No	63	35	35	
		47.4%	26.3%	26.3%	
Total		78	46	45	
		46.2%	27.2%	26.6%	

Table No 12: Stratification of Posterolateral Corner Injury with Obesity (n=169)

		Obesity		Total	P Value
		Yes	No		0.579
Posterolateral Corner Injury	Yes	10	26	36	
		27.8%	72.2%	100.0%	
	No	31	102	133	
		23.3%	76.7%	100.0%	
Total		41	128	169	
		24.3%	75.7%	100.0%	

Table No 13: Stratification of Posterolateral Corner Injury with Time Since ACL Tear (n=169)

		Time Since ACL Tear		Total	P Value
		< 3 Months	> 3 Months		0.274
Posterolateral Corner Injury	Yes	18	18	36	
		25.4%	18.4%	21.3%	
	No	53	80	133	
		74.6%	81.6%	78.7%	
Total		71	98	169	
		100.0%	100.0%	100.0%	

Table No 14: Stratification of Posterolateral Corner Injury with Ligamentous Laxity (n=169)

		Ligamentous Laxity		Total	P Value
		< 4	> 4		0.483
Posterolateral Corner Injury	Yes	32	4	36	
		22.2%	16.0%	21.3%	
	No	112	21	133	
		77.8%	84.0%	78.7%	
Total		144	25	169	
		100.0%	100.0%	100.0%	

Table No 14: Stratification of Posterolateral Corner Injury with Ligamentous Laxity (n=169)

		Ligamentous Laxity		Total	P Value
		< 4	> 4		0.483
Posterolateral Corner Injury	Yes	32	4	36	
		22.2%	16.0%	21.3%	
	No	112	21	133	
		77.8%	84.0%	78.7%	
Total		144	25	169	
		100.0%	100.0%	100.0%	

and SDs for BMI was 26.917 ± 2.99 . Mean and SDs for ligamentous laxity was 4.54 ± 1.150 . (Table No. 1). 141 (83.4%) patients were recorded in the 16-30 years age group while 28 (16.6%) patients were recorded in 31-40 years age group. (Table No. 2). 108 (63.9%) male and 61 (36.1%) female patients were recorded. (Table No. 3). 56 (33.1%) patients got injuries from hockey while 113 (66.9%) patients got injuries from playing football. (Table No. 4). 78 (46.2%) patients had injury in the right knee, 46 (27.2%) patients had an injury in their left knees while 45 (26.6%) patients had injuries in their bilateral knees. (Table No. 5). 41 (24.3%) patients were recorded obese. (Table No. 6). As per frequencies and percentages for posterolateral corner injury, 36 (21.3%) patients were recorded with posterolateral corner injury. (Table No. 7). Posterolateral corner injury was stratified with age, gender, type of sports injury, knee involved, obesity, time since ACL injury and ligamentous injury at Table No. 8 to 14 respectively.

DISCUSSION

The knee joint is one of the most commonly injured joints, as an isolated injury or a frequent component in a multiple trauma patient. The knee is a complex joint, consisting of two condylar joints between the corresponding condyles of femur and tibia and a patellar joint between the patella and femur^{1,11,12}. Injuries to the posterolateral corner of the knee occurring in isolation or in combination with injuries to the anterior cruciate ligament are uncommon and yet a common cause of ACL reconstruction failure. Posterolateral corner lesions have been estimated to occur in 9.1% of acute knee injuries with haemarthrosis and 16% of all knee ligament injuries^{2,13}. The diagnosis is usually missed at the time of the accident.

The main structures that make up the posterolateral corner of the knee are the lateral collateral ligament, popliteus tendon, popliteo-fibular ligament, and lateral knee capsule. Biomechanical studies have established that injuries to the posterolateral corner of the knee worsen the deleterious effects of tears in one or both cruciate ligaments³. A posterolateral corner injury that is not taken into account in the initial treatment strategy increases the risk of failure of procedures to reconstruct the central knee structures^{4,14}.

The posterolateral corner (PLC) structures interact functionally with the anterior cruciate ligament (ACL). They act as primary restraint to varus and external rotation. The ACL acts as a secondary restraint to varus angulation. Because of joint conformity of the lateral compartment of the knee and the inherent bony instability of the lateral tibial plateau, injuries of the PLC structures create a set of marked instability⁵. When this is combined with an ACL

tear, the instability is frank.

In the present study, mean and SDs for age was 25.70 ± 5.128 . Mean and SDs for time since ACL tear was 3.86 ± 1.210 . Mean and SDs for BMI was 26.917 ± 2.99 . Mean and SDs for ligamentous laxity was 4.54 ± 1.150 . (Table No. 1). 141 (83.4%) patients were recorded in 16-30 years age group while 28 (16.6%) patients were recorded in 31-40 years age group. (Table No. 2). 108 (63.9%) male and 61 (36.1%) female patients were recorded. (Table No. 3). 56 (33.1%) patients got injuries from hockey while 113 (66.9%) patients got injuries from playing football. (Table No. 4). 78 (46.2%) patients had injury in the right knee, 46 (27.2%) patients had injury in their left knees while 45 (26.6%) patients had injuries in their bilateral knees. (Table No. 5). 41 (24.3%) patients were recorded obese. (Table No. 6). As per frequencies and percentages for posterolateral corner injury, 36 (21.3%) patients were recorded with posterolateral corner injury. (Table No. 7).

In an ACL-PLC injured knee, an untreated PLC injury causes a significant increase in force on the ACL graft and may be a leading cause of graft failure. So the reconstruction should be combined⁶. In the setting of combined ACL-PLC reconstruction procedures, femoral tunnel intersection has been reported to be high.⁵ The close proximity of ACL and lateral collateral ligament tunnels in the lateral femoral condyle carries the risk of bone weakening and tunnel collision and hence compromises graft function^{7,14}.

Published data are difficult to assess, as most studies pooled patients with injuries to multiple medial and lateral ligaments, chronic and acute injuries, and/or one and both cruciate ligaments⁴. M Agha et al in a retrospective review multiligamentous knee injuries especially posterolateral corner injury in combination of anterior cruciate ligament injuries in 33.9% of patients⁸ which as compared to this study, 36 (21.3%) patients were recorded with posterolateral corner injury. (Table No. 7).

In another study by Temponi EF et al, one hundred sixty-two patients with MRI following ACL rupture were evaluated and thirty-two patients (19.7%) had concomitant injury to at least one structure of the PLC^{9,15,16} which as compared to this study, 36 (21.3%) patients were recorded with posterolateral corner injury. (Table No. 7).

CONCLUSION

It is of utmost importance to detect and treat the PLC injury properly. As PLC injuries are not usually diagnosed in the first place which can lead to failure of ACL reconstruction. Therefore, a thorough understanding of

functional interactions of the PLC, specific history taking, and precise physical examination are required for the diagnosis and treatment

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Authors Contribution:

Following authors have made substantial contributions to the manuscript as under

Authors	Conceived & designed the analysis	Collected the data	Contributed data or analysis tools	Performed the analysis	Wrote the paper	Other contribution
Muhammad R	✓	✗	✓	✗	✓	✗
Shah SDA	✓	✓	✗	✓	✓	✗

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical Approval:

This Manuscript was approved by the Research and Evaluation Unit of the College of Physicians and Surgeons of Pakistan
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