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Original Article

MRI Diagnosis and Grading of Anterior Cruciate Ligament Injuries

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ABSTRACT

The ACL aids in the stability of the knee. If the anterior cruciate ligament is stretched too far, it might rip. The tear could be partial through a section of the ACL or full through the entire ACL and all the way through the ACL following in 1.2.3 Grades of Sprain. **Objective:** To determine the grading and evaluation of ACL Injuries on Magnetic Resonance Imaging. M**ethods:** A Descriptive cross-sectional study was conducted in 9 months from January 2021 to September 2021. The data of 103 Patients were collected through convenient sampling in Radiology Department including Anterior Cruciate Ligament Injuries in all the population diagnosed on Magnetic Resonance Imaging (MRI). Physical complaints, Patient History, and Demographic data were displayed on patient reports and used for data analysis. MRI scans were performed on 1.5 T-Scanner (Phillips) and data were collected, recorded, and analyzed on SPSS as frequency tables and Pie Charts. **Results:** A total of 103 Patients were included following Grade 1, Grade 2 & Grade 3 Injuries. The data was collected and distributed into Three Age groups commonly 26-35 have 49 (47.6%) and the occurrence of ACL Injuries in specific gender as 74 females and 29 males. Grade 1 contains 49 (47.6%). The Grade 2 Injuries on ACL evaluated the frequency 35 (34%) Partial Tear which is due to a stretch but did not tear and making ligament loosen it. Grade 3 has the most Severe ACL Injuries with Complete Ligament Tear diagnosed on Magnetic Resonance Imaging and shows the frequency of 19 (18.4). Female Patients related with Athletics and Sports activities were more common.**Conclusion:** In conclusion the ACL Injuries are more prevalent in Female because of Sports and Athletic Injuriesbecause of the smaller intercondylar notch. Females are three times more probable to sustain ACL injuries. The Reliable diagnosis of ACL injuries is by MRI showing excellent accuracy in early detection.

INTRODUCTION

The three bones that make up the knee joint are the femur (thighbone), tibia (shinbone), and the knee cap (patella)[1]. Knee Ligaments are the connective tissue that holds the knee bones together. The four primary ligaments in your knee are held together and [1-2] functions as strong cables connecting the bones to stabilize your knee joint and controls all movement[3]These ligaments can be found inside the knee joint and create a shape of X alphabet in which the anterior side is formed by anterior cruciate ligament and posterior side by the Posterior cruciate ligament[4]. These cruciate ligaments govern the back and forth movements to keep the mobility of the knee. The anterior cruciate ligament rounds diagonally through the middle of the knee[5]. It keeps the tibia from slipping at the front of the femur and provides the knee rotational stability. Damage to other knee components including articular cartilage, meniscus, or other ligaments is observed in about 50% of all anterior cruciate ligament injuries [6]. Ligament injuries are considered sprains and graded on a scale considering their severity. Grade 1: The Sprain in which ligament is slightly harmed and somewhat stretched but still has the ability to stabilize the knee joint grade 2: The ligament is strained to the point of where it became loose and decreases strength and called as a partial ligament tear Grade 3: It is considered as the complete tear of the ligament which May broke into two

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sections causing instability in the knee joint injuries, which are usually related with sports and athletic injuries and are projected to people related with sports. It affects about 80,000 people in the United States [7]. Partially torn ACLs are unusual and majority of the people have ACL injuries forming full or near-complete rips [8]. The possible causes for the anterior cruciate ligament injury are abruptly changing directions, stopping unexpectedly, slowing down when jogging, landing awkwardly after a jump, and direct contact or impact such as a football tackle. The ligament is stretched to the point of in elastically loose and falls in a Grade 2 Sprain [8]. Around 17% of the population is between the ages of 25 and 30 with that percentage expected to raise to 20% by 2030[9]. According to various studies, female athletes had a greater prevalence of ACL injury than male participants in several sports[10]. This could be related to differences in physical training, strength of muscle, and n control of neuromuscular activities[11].The differential aspects in females from male structure such as pelvis and lower extremity (leg) alignment, ligament looseness, and estrogen's effects on ligament characteristics are all possible reasons. The anterolateral ligament (ALL) in the knee has subsequently received considerable attention in damaging [12]. According to various anatomical studies published the affects denoted the 83–100% of persons. It begins on the lateral femoral condyle and travels obliquely downward and forward [13]. ALL inserts on the lateral border of the tibial plateau [14]. In the examination of internal derangement of knee, the MRI of the knee has become routine procedure for better evaluation [15]. The normal MR appearances of the anterior cruciate ligament (ACL), as well as the criteria for identifying an ACL injury, have been documented in past studies which is helping in proper diagnosis and prompt treatment [16]. Following previous literature categories' have already been defined for meniscal tears. ACL tears, on the other hand, do not have any specific MR classification [17]. The prevalence of the various ACL tear patterns occurs and that can be identified on MRI. MRI is a safe and reliable alternative to diagnostic arthroscopy has long been thought to be harmful scanning of the knee joint rather than MRI. For meniscal or ACL concerns in Injury, MRI scan is usually utilized to confirm the diagnosis before recommending an arthroscopic examination and surgery [18]. Meniscal tear identification can be difficult to interpret and it depends on the observer as well as the scanner's sensitivity. During a clinical evaluation, similar difficulties may develop [19]. In current study the objective was to employ MRI instead of arthroscopic findings in the diagnosis of anterior cruciate ligament (ACL) injuries. The purpose of this research was to find out how often and accurately certain MRI patterns of ACL rupture.

METHODS

It is a descriptive cross-sectional study conducted in a Private Sector Hospital of the Secondary level in Gujranwala. This study was conducted in 9 months from January 2021 to September 2021. The data of 103 Patients were collected through convenient sampling in Radiology Department including Anterior Cruciate Ligament Injuries in all the population diagnosed on Magnetic Resonance Imaging (MRI). Physical complaints, Patient History, and Demographic data were displayed on patient reports and used for data analysis. MRI scans were performed on 1.5 T-Scanner (Phillips) and Injuries were graded. Data was collected and Recorded on the SPSS data entry sheet. Data were analyzed as frequency tables and Pie Charts. Frequencies of Anterior Cruciate ligament injuries were mentioned.

RESULTS

A total of 103 patients were included in the study for 9 Months following Grade 1, Grade 2 & Grade 3 Injuries. The data was collected and distributed into Three Age groups Mentioned in Table 1 of 15-25 which contains 30 (29%), 26-35 age groups have 49 (47.6%) and 36-45 have 24 (23%). The data was recorded to evaluate the occurrence of ACL Injuries in a specific gender and found that out of 103 there were 74 females and 29 males mentioned in Table 2. In Table 3 MRI diagnosis evaluated the Anterior Cruciate Injuries into 3 grades following Grade 1 contains 49 (47.6%). Grade 1 Have least Severe ACL Injury which was minimally stretched and ligament still intact and working. The Grade 2 Injuries on ACL evaluated the frequency 35 (34%) which contains the patients having Partial Tear which is due to a stretch but did not tear and making ligament loosen it. Grade 3 has the most Severe ACL Injuries with Complete Ligament Tear diagnosed on Magnetic Resonance Imaging and shows a frequency of 19 (18.4).In Table 4 MRI diagnosis evaluated the Anterior Cruciate Injuries were more common in Patients associated with Athletics and Sports activities as compared to non-athletic People. A total of 56.3 were Athletes and 43.7 were non-Athletes.

	Age Groups				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15-25	30	29.1	29.1	29.1
	26-35	49	47.6	47.6	76.7
	36-45	24	23.3	23.3	100.0
	Total	103	100.0	100.0	

Table 1: Frequency of Age Groups

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	Gender				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	29	28.2	28.2	28.2
	Female	74	71.8	71.8	100.0
	Total	103	100.0	100.0	

Table2: Gender distribution

	Grade of ACL Injury				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Grade 1 ACL Injury	49	47.6	47.6	47.6
	Grade 2 ACL Injury (Partial Tear)	35	34.0	34.0	81.6
	Grade 3 ACL Injury (Complete Tear)	19	18.4	18.4	100.0
	Total	103	100.0	100.0	

Table 3: Frequency of Grade 1, Grade 2 and Grade 3 Injury

	Athletes or Non-Athletes				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Athlete	58	56.3	56.3	56.3
	Non Athlete	45	43.7	43.7	100.0
	Total	103	100.0	100.0	

Table 4: Athletes and Non- Athletic Distribution

DISCUSSION

The most prevalent injuries are injuries that aren't caused by contact, which are the result of forces generated by the athlete's body. Women are three times more prone than men to develop ACL injuries due to the intercondylar notch, and certain female non-athletes with knee osteoarthritis are vulnerable to ACL damage between the ages of 25 and 35. ACL injury risk factors are divided into two categories: internal and external. Competition type, footwear and surface, and environmental conditions are all external risk factors to consider. Anatomical, hormonal, and neuromuscular characteristics are all internal risk factors.In Current study the age group of 15-25 contains ACL Injuries 30 (29%) and 26-35 age groups have 49 (47.6%) which shows the occurrence of ACL injuries following Grade 1 contains 49 (47.6%). Grade 1 Have least Severe ACL Injury which was minimally stretched and ligament still intact and working. The Grade 2 Injuries on ACL evaluated the frequency 35 (34%) of which contains the patients having Partial Tear which is due to a stretch but did not tear and making ligament loosen it. Grade 3 has the most Severe ACL Injuries with Complete Ligament Tear diagnosed on Magnetic Resonance Imaging and shows the frequency of 19 (18.4). Faustine F. Dufka in 2016 also shows anterior cruciate ligament (ACL) injury MRI features and related findings in relation to skeletal maturity. Over the course of four years, 82 consecutive knees with an MRI report diagnosis of ACL damage (partial tear, sprain, or total tear) or tibial spine avulsion fracture were analyzed. ACL injuries are more common in patients with weakened bones in their 20s. Avulsion fractures and partial rips of the tibia are more prevalent in younger, less inflexible bones that can absorb shock stresses [20]. Complete ACL tears and accompanying injuries become more common in youngsters as they get older, reaching adult patterns. In the current study, MRI indicates diverse MRI patterns of ACL rupture, as well as their frequency and accuracy. Moon Jong Chang MD performed ACL repairs on 156 knees in 2013 and divided the status of the AM and PL bundles into three main categories as fully torn, attenuated and intact. The bundles were then analyzed on MRI and grouped into the three categories for 77 individuals who received an MRI at our facility using a routine technique [21]. The diagnostic accuracy of MRI was calculated, and it was discovered that MRI can assist surgeons in accurately predicting bundle injury patterns, however, caution should be exercised when predicting PL bundle injury using MRI with a short acquisition time after injury. In the current study MRI diagnosis evaluated the Anterior Cruciate Injuries were more common in Patients associated with Athletics and Sports activities as compared to non-athletic People. A total of 56.3 were Athletes and 43.7 were non-Athletes. Out of 103, there were 74 females and 29 males mentioned Christopher C Keding also obtained same results in 2017 that Injuries to the anterior cruciate ligament are becoming more prevalent in the United States of America. This is linked to an increase in high school athletic involvement, particularly among female players of young age. The non-contact approach is responsible for a large percentage of these injuries. Enrolling young athletes in jump-training programs could significantly reduce the occurrence of these non-contact injuries[22]. Focused physical examinations are utilized to diagnose ACL injuries, which can yield a high index of suspicion. Although radiographs are beneficial in screening out other problems but MRI is the gold standard Imaging Modality for diagnosing ACL damage and has proven to be quite accurate.

CONCLUSION

In conclusion the ACL Injuries are more common in Female because of Sports and Athletic Injuries due to smaller intercondylar notch. Women are three times more probable to sustain ACL injuries specifically in young age groups. Some non-athletic females with knee osteoarthritis are predisposed to ACL injury between the ages of 35 to 45. The Reliable Imaging Modality for the diagnosis of ACL injuries is MRI, which has shown excellent accuracy in early detection and prompt treatment plans.

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