

# Anterior Cruciate Ligament Tears: Epidemiology in the Indian Armed Forces

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## Abstract

**Introduction:** The present study aimed to assess the epidemiology of ACL tears which required operative treatment in the form of ACL reconstruction. Only patients who had arthroscopically confirmed ACL tears were included in the study.

**Methods:** The present study was conducted at a tertiary referral center for 24 months. History of mode of injury was elicited from a total of 400 patients either telephonically or before undergoing arthroscopic ACL reconstruction and the outcomes were studied, tabulated and analyzed.

**Results:** From the tabulated results it was inferred that 47 % of patients sustained ACL tears due to sports related injuries and 32% due to training related in which jumping over a 9 ft ditch was responsible for 62.5% cases.

**Conclusion:** Musculoskeletal injuries affecting the lower extremity, and the frequency and severity of these injuries may negatively impact force readiness. Training modules should be designed to make soldiers aware of the possible injury and efforts should be made to reduce the incidence of ACL tears.

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**Keywords:** Anterior cruciate ligament, Battle physical efficiency test

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## Introduction

Anterior cruciate ligament (ACL) injuries are a serious concern for physically active young and adolescent population. The ACL is 1 of the 4 major ligaments that stabilizes the knee joint. Its main function is to prevent anterior translation of tibia relative to the femur. The ACL also assists with preventing excessive knee extension, knee varus and valgus movements, and tibial rotation [1,2]. An intact ACL protects the menisci from shearing forces that occur during athletic maneuvers, such as landing from a jump, pivoting, or decelerating from a run. The mechanism of ACL injuries in athletes is likely multifactorial. Proposed theories to explain the mechanisms underlying ACL injury include extrinsic (physical and visual perturbations, bracing, and shoe-surface interaction) and intrinsic (anatomic, hormonal, neuromuscular, and biomechanical) variables. Identification of extrinsic and intrinsic risk factors associated with the ACL injury mechanism provides

direction for targeted interventions to high-risk individuals. At least 70% of ACL injuries are noncontact in nature; however, the specific definition of a noncontact ACL injury varies from study to study [3,4]. Some define a noncontact ACL injury as one that occurs in the absence of a player to-player (body-to-body) contact. Others define noncontact ACL injury as one that occurs in the absence of a direct blow to the knee. An ACL injury resulting from body-to-body contact but with no direct blow to the knee may be classified as "Noncontact ACL injury with perturbation."

The incidence of ACL injuries in the general population can be estimated from national registries, which were established in Norway (2004), Denmark (2005), and Sweden (2006) to monitor the outcomes of ACL reconstruction surgery. This number underestimates the true incidence of ACL injuries, however, because it does not include those treated non-operatively. Most ACL injuries are sports-related therefore; injury rates are higher in athletes. ACL injury rates were highest in men's spring football and women's gymnastics (33 per 100,000 athlete-exposures). In women's sports, ACL injury rates represented a larger proportion of total injuries than in men's sports (3.1% vs 1.9%), with women's basketball and women's gymnastics topping the list at 4.9% of total injuries [5]. No

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well-designed epidemiologic studies have been conducted world over to document ACL injury epidemiology in the Armed forces. However, ACL ruptures in Royal marine basic training has been evaluated by A.M Wood et al where they have concluded that ACL injuries are not common in Royal Marine Training, the cause of most ACL tears was fall/ twisting injuries in training obstacles and reconstruction is not a bar to completing Royal Marine basic training. Injury Epidemiology of U.S. Army Special Operations Forces reveals that injuries to the knee accounted for 23.1% of all training related injuries and the commonest causes of all injuries were running (23.1%), lifting heavy weights (19.2%), cutting and coning (11.5%), direct Trauma (11.5%), landing (7.7%), fall (3.8%) and marching (3.8%). Similarly, Anterior Cruciate Ligament Injury in Female Athletes: Epidemiology Mary Lloyd Ireland, MD Kentucky Sports Medicine Clinic, Lexington, KY concluded that a significantly increased risk of noncontact ACL injury have been noted in female soccer and basketball athletes when compared with male athletes.

## Materials and Methods

### Study Design

A prospective and retrospective study was conducted in Command Hospital, Chandimandir, Haryana from 2016 to 2019 on 400 patients for assessment of the mode of injury. All 400 cases were either telephonically contacted or were quizzed at the time of admission or in the post-operative period.

### Study Population

#### Inclusion Criteria

1. Age < 40 years- Actively serving in the Indian Armed Forces.
2. All the cases with ACL tear- Arthroscopically proven tears.

#### Exclusion Criteria

1. Age > 40 years- Dependents/ Ex-Service personnel
2. Evidence of multi-ligament injuries/ other ligament injuries.

#### Sample Size

All patients requiring anterior cruciate ligament reconstruction were to be included in the study. Based on previous year records from the statistical department of this hospital average amounted to be around 160 cases of Arthroscopic ACL ligament reconstruction per year.

#### Study Procedure

Ethical clearance was obtained from institutional ethics committee of the hospital before start of study. Written informed consent was obtained from each subject before eliciting history from the patient. A list of patients who had undergone ACL reconstruction was tabulated. All 400 patients were either contacted telephonically or were asked about the mode of injury when the patients reported for review at our center. The collected data was tabulated by the interning doctor into sports related injuries, military training related injuries and civil related trauma. The sports injuries were further sub-classified into the type of sport in which the individual was involved at the time of sustaining the injury. Training related injuries were sub-divided into injuries while undergoing battle readiness examination which mostly was due to twists and falls sustained while running for 5 kms. The other subheads included jumping across a 9 feet ditch after the 5 km run and falls during obstacle course training. Injuries sustained by individuals due to non-military activities for example road traffic accidents, twisting injuries and falls at home were also tabulated separately.

#### Result

The study of 400 patients who underwent arthroscopic ACL ligament reconstruction were evaluated for mode of injury and the result was tabulated as follows:

**Table 1: ACL tear mode of Injury in The Indian Armed Forces**

Sports Related Injuries	Volleyball	Football	Basketball	Cricket	Wrestling	Kabbadi
	44	<b>68</b>	16	12	16	32
Training Related Injuries	Battle Physical Examination Test (BPET)	Jumping across a 9 ft ditch	Obstacle course training			
	32	<b>80</b>	16			
Civil Related Trauma	Road Traffic Accident	Twisting Injuries	Falls at home/ unit lines (Mostly from Staircase)			
	20	36	28			

From the tabulated results it can be inferred that in a subset of actively serving military population, 47 % of patients sustained ACL tears due to sports related injuries of which 36 % of injuries were sustained due to football (Table 1). It also can be concluded that football being a popular sport in the armed forces accounted for 17% of the ACL tears as a whole. It was also found that training related injuries lead to 32% of all ACL tears in which jumping over a 9 ft ditch was responsible for 62.5% cases of these injuries and 20% of all the ACL tears as a whole. Also 28% injuries (112 patients out of 400) sustained ACL tears due to BPET an exercise carried out for battle readiness. It was further noted that 21% patients either had a fall at home or sustained a road traffic accident which was not attributable to military activities.

## Discussion

In studies of Texas high school football and basketball injuries, knee injuries were most common in girls' basketball, with a 2.1 times greater risk of knee injury per hour of exposure in females [6-8]. The risk of injury in both males and females was greater during games than during practices. Observations of ACL injury mechanisms in basketball show the athlete coming down in an uncontrolled landing, either catching the ball or trying not to go out at the baseline. Another study by Olsen et al suggested that 6 of 20 cases of ACL injury were indirect and 1 of 20 were direct [9]. Meanwhile, other research has shown that one such training strategy, restraining internal tibial rotation, makes it more difficult for the ACL to be injured because it reduces the compressive impact load on the knee [10].

From the studied data of our study, we have found that the most common sport causing ACL injuries to be football and volleyball as compared to the international statistics which is soccer and basketball. This difference is mostly due to the fact that basketball requires more infrastructure and therefore is a less popular sport in the armed forces as compared to volleyball. On careful examination of history, we concluded that in training related injuries jumping across a 9 feet ditch was the commonest cause of ACL tears as most patients had muscular fatigue after running for 5 kms. It was also elicited from the history that most patents claimed that they were apprehensive in undertaking the jump across a 9 feet ditch before sustaining the injury. Most of the 74 patients (18.5%) who had sustained an injury due to trivial twisting and falls at home had given some history which was suggestive of an injury sustained while training for military activities. It would be therefore just to conclude that these subset of patients would probably have sustained some kind of partial tears of ACL during training activities which would have become complete due to subsequent twists and falls.

ACL injury risk in young athletes is likely multifactorial. This study of Japanese judo players found that certain stances left players exposed to kicks that could result in contact ACL ruptures [11]. As a result, specific neuromuscular training intervention programs have been developed, including the Harmo Knee program in Sweden for soccer players and the Sports metrics program in the United States for such sports as basketball and volleyball to prevent ACL injuries in athletes and sports men [12]. Tactical trainings should be focused through proper technique and training intensity/duration and should be tailored according to individuals.

## Conclusion

Musculoskeletal injuries affecting the lower extremity, and the frequency and severity of these injuries may negatively impact force readiness. Implementation of injury prevention and human performance programming is critical. ACL tears pose a huge economic burden on the society and therefore attempts should be made to prevent this injury. We concluded from our study that one of the preventable injuries that lead to ACL tears was jumping across a 9 feet ditch. In most cases individuals were asked to jump across the 9 feet ditch after running for 5 kms, this would have caused muscular fatigue. Hence we recommend that individuals should be adequately rested before undertaking the jump, individuals should be given a choice and jumps should not be mandatory on all days of battle worthiness exercises. Furthermore, it can be considered to reduce the length of the ditch or length should be decided according to the height of the individuals. Training modules should be designed to make soldiers aware of the possible injury and efforts should be made to reduce the incidence of ACL tears.

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