



ORIGINAL RESEARCH PAPER

Orthopaedics

EPIDEMIOLOGY OF ANTERIOR CRUCIATE LIGAMENT INJURIES IN CENTRAL INDIA

KEY WORDS: Anterior cruciate ligament injuries, Sports, Occupational, Non-sports, Epidemiology.

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ABSTRACT

Aim: To describe the epidemiological profile of Anterior Cruciate Ligament (ACL) injuries at a centre in Central India. **Methods:** The present study was a retrospective record review of patients with ACL injuries over the last three years. Demographic data, mode of injury, body mass index and clinical presentation was noted. Extent of disability was assessed using Tegner score categorized as severe (<5), moderate (6-8) and mild (>8) respectively. Time delay between injury and clinical presentation was also noted. Pain was measured on a 10-point VAS scale. SPSS 17.0 was used to analyse the data. Chi-square and Independent samples 't'-tests were used to compare the data. **Results:** Age of patients ranged from 18 to 54 years. Maximum patients (44.3%) were aged 18-25 years. Mean age was 29.18±8.64 years. Majority of patients were males (78.7%), had moderate disability (60.6%), unilateral (91%) involvement and moderate pain (93.4%). Sports injuries (73%) were the major cause. Mean time gap between injury and clinical presentation was 11.24±8.21 months. Females as compared to males had significantly lower age (p=0.023), lower BMI (p=0.025), non-sports injuries (p=0.044), longer time gap between injury and clinical presentation (p<0.001) and lower mean VAS scores for pain (p=0.003). Sports as compared to non-sports injuries occurred in significantly younger (p<0.001), women (p=0.045) and lower BMI (p=0.005) patients and had significant association with severe disability (p=0.014), bilateral involvement (p=0.034) and early presentation (p=0.021). **Conclusion:** Sports injuries in young population were the most common cause with differences in epidemiology affected by gender and mode of injury.

INTRODUCTION

Anterior cruciate ligament (ACL) injury is a common athletic injury and one of the most commonly treated conditions of the knee¹. Estimated rates of anterior cruciate ligament reconstructions performed per year in the United States range widely from 60,000 to 175,000^{2,3}. In India, the epidemiology regarding ACL reconstruction is not systematically reported, however in big centres 20 to 100 procedures have been reported each year⁴⁻⁷.

Although western literature reports it primarily as an athletic injury^{8,9} yet in developing and eastern countries, most of the studies have reported majority of their patients with ACL injuries from amongst non-athletes^{6,7,9,10}.

In present study, we describe the epidemiology of ACL injuries in a tertiary care centre in Central India.

MATERIAL AND METHOD

The present study was a retrospective record review of ACL injury patients over the last three years at a tertiary care centre in Central India. Three years' records of ACL injury patients were retrieved after obtaining permission from the institutional authority. The inclusion criteria was age >18 years and presentation between January 1, 2017 to December 31, 2019. Records of those presenting with concomitant bone injuries, ACL injuries due to trauma and incomplete information were excluded.

Demographic data viz. age and sex was noted, details related with body mass index, type of injury (sports, occupational, other modes) and side of involvement (unilateral/bilateral) were noted. Estimation of level of disability was done using Tegner activity scale (TAS)¹¹. TAS scores ≤5, 6-8 and >8 were considered as indicators of mild, moderate and severe disability. Time gap between injury and presentation was noted. Pain at the time of presentation was noted using visual analogue scale (VAS) at a scale of 0-10. VAS scores <5, 6-7 and 8-10 were defined as no/mild pain, moderate pain and severe pain respectively.

Data so collected was fed into computer using Microsoft Excel 2013 software. Data was analysed using Statistical Package for Social Sciences (SPSS) version 17.0. Comparisons between

males and females and between sports and non-sports injuries were made using Chi-square and Independent samples 't'-tests respectively. A 'p' value less than 0.05 was considered to be statistically significant.

RESULTS

During the period, a total of 122 records fulfilling the inclusion and exclusion criteria were identified. Age of patients ranged from 18 to 54 years. Maximum number of patients were aged 18-25 years (44.3%) followed by those aged 26-35 years (35.2%) and 36-46 years (15.6%) respectively. Only 6 (4.9%) patients were aged >45 years. Mean age of patients was 29.18±8.64 years. Majority of patients were males (78.7%). The sex ratio (M:F) was 3.69. Body mass index (BMI) of patients ranged from 18.5 to 27.9 kg/m². Nearly three quarter (74.6%) patients had BMI in 18.5-24.9 kg/m² (normal weight) category while remaining 31 (35.4%) had BMI in 25.0-29.9 kg/m² (overweight) range. Mean BMI of patients was 23.06±2.37 kg/m². Majority of patients had moderate disability (60.6%) followed by those having severe disability (32.8%) and mild disability (6.6%) respectively. Sports (73.0%) was the most common cause/type of injury followed by occupational injuries (11.5%). A total of 19 (15.6%) had other causes of injury. Most the cases (91%) had unilateral injury. A total of 11 (9%) had bilateral injury. Time gap between injury and presentation ranged from 3 to 36 months. Maximum (44.3%) presented between 7 and 12 months followed by those presenting within 6 months (33.6%), between 13 and 4 months (16.4%) and >24 months (5.7%) respectively. Mean time gap was 11.24±8.21 months. VAS scores for pain ranged from 6 to 8. Moderate pain was reported by most of the patients (93.4%). There were 8 (6.6%) patients reporting severe pain. Mean VAS score for pain was 6.58±0.61 (Table 1).

Comparison of demographic and clinical profile of male and female ACL injury patients revealed no statistically significant differences between two sexes for level of disability (p=0.464) and laterality (p=0.070). However, a significant difference between two sexes was observed for age, BMI, type of injury, time gap between injury and presentation and mean VAS scores for pain (p<0.05). Females as compared to males had significantly lower mean age (p=0.023), mean BMI (p=0.025) and mean VAS scores

($p=0.003$) but had significantly higher proportion of sports injuries ($p=0.044$), presentation after 12 months ($p<0.001$) (Table 2).

Comparison of demographic and clinical profile of sports and other causes of injuries showed that sports injury affected patients at a significantly younger mean age ($p<0.001$), more females had sports injuries as compared to other injuries ($p=0.005$), sports injuries were associated with significantly higher disability level as compared to non-sports injuries ($p=0.014$), had bilateral involvement ($p=0.034$) and had higher proportion of patients presenting within 12 months ($p=0.021$). No significant difference in mean VAS scores was observed between sports and other injuries ($p=0.356$) (Table 3).

DISCUSSION

ACL injuries are relatively rare as they are known to affect persons with specific activity profile, such as sportsperson, hence most of the epidemiological series are retrospective in nature and do not have many patients. In present study, during a three-year record review we found a total of 122 eligible records thus showing an annual incidence of nearly 41 cases at our facility. Epidemiological series from other parts of India too comprise of patients ranging from 100 to 363 in number over a period of two to five years¹²⁻¹⁴, thus showing an annual incidence ranging from 50 to 60 per year.

In the present study, age group 18-25 years was most commonly affected (44.3%) and study population was predominantly male (78.7%). John *et al.*¹² in their study included patients aged 16-45 years and reported had 92.8% males. In the study by Kochhal *et al.*¹³, patients aged <25 years comprised 54% of the patients and proportion of males was 90.3%. Mean age of patients in the present study (29.18±8.64 years) was close to that reported by Gera *et al.*¹⁴ (29.26 years) who also reported a male dominance (89%). Compared to other studies, the proportion of females was slightly higher in present study. The reason for this could be growing interest of women in sports activities. Recent years have seen outstanding performances from Indian women sportspersons and athletes, thus motivating more women to participate in sports activities which happen to be the most dominant risk factor for ACL injuries.

In present study, mean BMI of affected patients was 23.06±2.47 kg/m² and majority of them were in normal weight category (74.6%). Compared to present study, mean BMI of patients in the series of Gera *et al.*¹⁴ was 24.02 and they included patients in underweight (BMI as low as 16.46 kg/m²) as well as obese (BMI as high as 32.85 kg/m²). However, in present study none of the patients were either underweight or obese. John *et al.*¹² in their study reported the mean BMI of patients as 25.97 and similar to present study found 66.5% of patients in normal weight category. As such ACL injuries generally affect the sportspersons who tend to be physically fit as reflected by their BMI profile, thus leaving no room for underweight or obese patients.

In present study, moderate to severe disability affected 93.4% patients. ACL injuries are cause of significant disability, especially among sportspersons. In the study by John *et al.*¹⁶ as much as 60.2% ACL injuries patients could not return to sports even after rehabilitation. In fact, it is the disability to participate in sports activities and normal routine that prompts the patients to seek medical support.

In present study, sports injuries comprised 73% of total injuries while 11.5% injuries were occupational in nature, they included police and services personnel while 15.6% injuries were caused by other causes including road traffic accident. Compared to present study, Gera *et al.*¹⁴ in their study reported 50% of injuries to be caused by road traffic accident. However, John *et al.*¹² in their study had all the patients with sports related injuries. Kochhal *et al.*¹³ too found

road traffic accidents to be the major cause of ACL injuries in their series. Compared to these studies, the injury profile of patients in the present study is more close to western studies that document ACL injuries to be predominated by sportspersons and athletes^{8,9}.

In present study, bilateral involvement was seen in 11 (9%) cases only. Compared to this, Kocchal *et al.*¹³ in their study reported bilateral injuries in only 1% of patients. The higher proportion of patients with bilateral injuries in present study could be owing to a higher proportion of sportspersons. Sportspersons tend to give more than 100% during their sporting events and training and even tend to compete and train despite inflicting an injury thus exposing them to greater chances of recurrence in the other limb which becomes the dominant limb owing to handicap in the affected limb.

In the present study, most of the patients presented within 12 months of injury (77.9%). Mean time gap between injury and presentation was 11.24±8.21 months. Compared to the present study, John *et al.*¹² in their study reported mean time gap to be 6.15 months. Relatively longer mean gap in present study could be owing to the fact that while John *et al.*¹² conducted their study among sportspersons only, in the present study, a sizeable proportion of injuries were attributable to non-sports injuries. ACL tear is a major barrier for sportspersons for participation in sports as compared to other occupations where it does not affect routine life to a great extent and hence presentation is often delayed. It seems that in the present study, most of the patients visited our facility when the accompanying pain became moderate to severe.

In the present study, affected women tended to be relatively younger, having low BMI, higher proportion of sports injuries, delayed presentation and lower pain severity as compared to males. Younger age of women and sports dominance seem to complement each other. Women as compared to men have a relatively shorter sports career. Most of the women athletes tend to retire after attaining motherhood and that is why the mean age of women sportspersons is lower as compared to that of men. In present study, all the women inflicting ACL injuries were sportspersons thus showing that non-sports ACL injury risk is relatively lesser in women. Compared to present study, the relatively lower proportion of women in the series of Kochhal *et al.*¹³ and Gera *et al.*¹⁴ who had a dominance of non-sports injuries could be well-explained by the observation that women tend to have lower risk of non-sports injuries as proven in the present study. A delayed clinical presentation of women as compared to men could also be attributable to the socioeconomic reasons like shorter sports-lifespan of women athletes, lack of adequate financial support and unwillingness of injured women sportspersons to return to track in view of social pressure.

In the present study, sports injuries as compared to other causes of injuries occurred in relatively younger age, affected higher proportion of females, were associated with greater disability, had greater proportion of those with bilateral involvement and had shorter time gap between injury and presentation.

These findings in general show that sports have an important place both in occurrence as well as treatment of ACL injuries. Owing to shorter lifespan of sports activities, sports are generally joined at a younger age especially by women. The disability caused by non-participation in sports is of greater extent in sportspersons rather than those who inflict such injuries for non-sports causes.

The findings of present study showed some changing trends of ACL injury epidemiology in India, especially in context with proportion of women and emergence of sports as the major cause of injury. Further studies to corroborate the findings of present study are recommended.

CONCLUSION

The epidemiological profile of ACL injuries at a tertiary care centre in Central India showed a dominance of sports injuries and a relatively higher proportion of women. The study also showed an increased desire to get rehabilitation in sportspersons as compared to those afflicting these injuries in non-sportspersons. In general ACL injuries affected young individuals in their productive years of life and mainly affected the male sportspersons.

Table 1: Demographic Profile And Clinical Profile Of ACL Injuries Patients (n=122)

SN	Characteristic	Statistic
1.	Age (in years)	
	18-25 Years	54 (44.3%)
	26-35 Years	43 (35.2%)
	36-46 Years	19 (15.6%)
	>45 Years	6 (4.9%)
	Mean age±SD (Range) in years	29.18±8.64 (18-54)
2.	Sex	
	Male	96 (78.7%)
	Female	26 (21.3%)
3.	Body Mass Index (kg/m ²)	
	18.5-24.9 (Normal weight)	91 (74.6%)
	25.0-29.9 (Overweight)	31 (35.4%)
	Mean BMI±SD (Range) kg/m ²	23.06±2.47 (18.5-27.9)
4.	Tegner Score at presentation	
	Mild disability (>8)	8 (6.6%)
	Moderate disability (6-8)	74 (60.6%)
	Severe disability (≤5)	40 (32.8%)
5.	Type of injury	
	Sports	89 (73.0%)
	Occupational	14 (11.5%)
	Others	19 (15.6%)
6.	Laterality	
	Unilateral	111 (91.0%)
	Bilateral	11 (9.0%)
7.	Time gap between injury and presentation	
	≤6 months	41 (33.6%)
	7-12 months	54 (44.3%)
	13-24 months	20 (16.4%)
	>24 months	7 (5.7%)
	Mean time gap±SD (Range) in months	11.24±8.21 (3-36)
8.	Pain score (VAS)	
	No/Mild pain (<5)	0
	Moderate pain (6-7)	114 (93.4%)
	Severe pain (8-10)	8 (6.6%)
	Mean VAS score±SD (Range)	6.58±0.61 (6-8)

Table 2: Comparison Of Demographic Profile And Different Clinical Factors Between Male And Female Patients Of ACL Injuries

SN	Characteristic	Males (n=96)		Females (n=26)		Statistical significance		
		No.	%	No.	%	χ ² /t	'p'	
1.	Mean age±SD (years)	30.26±9.15 (18-54)		25.92±5.35 (19-39)		t=2.309; p=0.023		
2.	Mean BMI±SD (kg/m ²)	23.32±2.56 (18.5-27.9)		22.10±1.89 (19.1-25.8)		t=2.266; p=0.025		
3.	Tegner Score at presentation					1.536	0.464	
		>8	7	7.3	1			3.8
		6-8	60	62.5	14			53.8
		≤5	29	30.2	11			42.3

4.	Type of injury	Sports	66	68.8	23	88.5	6.326	0.044
		Occupational	11	11.5	3	11.5		
		Others	19	19.8	0	0		
5.	Laterality	Unilateral	85	88.5	26	100	3.274	0.070
		Bilateral	11	11.5	0	0		
6.	Time gap between injury and presentation	≤6 months	36	37.5	5	19.2	18.04	<0.001
		7-12 months	46	47.9	8	30.8		
		13-24 months	12	12.5	8	30.8		
		>24 months	2	2.1	5	19.2		
7.	Mean pain score (VAS)±SD	6.67±0.63		6.27±0.45		t=3.023; p=0.003		

Table 3: Comparison Of Demographic Profile And Different Clinical Factors Between Sports And Other Causes Of ACL Injuries

SN	Characteristic	Sports Injuries (n=89)		Other causes (n=33)		Statistical significance		
		No.	%	No.	%	χ ² /t	'p'	
1.	Mean age±SD (years)	26.94±7.44		35.79±8.46		t=5.615; p<0.001		
2.	Sex	Male	66	74.2	30	90.9	4.028	0.045
		Female	23	25.8	3	9.1		
3.	Mean BMI±SD (kg/m ²)	22.68±2.37		24.09±2.49		t=2.885; p=0.005		
4.	Tegner Score at presentation	>8	7	7.9	1	3.0	8.489	0.014
		6-8	47	52.8	27	81.8		
		≤5	35	39.3	5	15.2		
5.	Laterality	Unilateral	78	87.6	33	100	4.483	0.034
		Bilateral	11	12.4	0	0		
6.	Time gap between injury and presentation	≤6 months	33	37.1	8	24.2	9.744	0.021
		7-12 months	42	47.2	12	36.4		
		13-24 months	9	10.1	11	33.3		
		>24 months	5	5.6	2	6.1		
7.	Mean pain score (VAS)±SD	6.55±0.60		6.67±0.65		t=0.927; p=0.356		

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