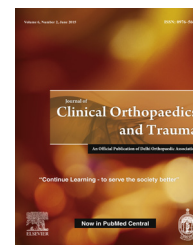


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Original Article

Epidemiological profile of sports-related knee injuries in northern India: An observational study at a tertiary care centre

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ABSTRACT

Background: Sports-related knee injuries occur commonly in athletes. However, there is no published epidemiological study from India till date.

Objectives: The purpose of this study was to identify common injuries sustained by Indian athletes participating in different sports and to study various associated demographic features. A secondary objective was to investigate different factors, which may affect return to sport by the athlete.

Study design: Cross-sectional study (observational study).

Study centre: Sports injury clinic, PGIMER, Chandigarh.

Methods: Out of 465 athletes who presented to us with sports-related knee injuries over a 5-year period, 363 athletes (from 24 different sports) with complete records were identified. Data were analysed for demographic features, type of sport, mechanism of injury, injury scenario, athlete's level of play, injury duration at presentation, injury patterns and type of management. Telephonic interviews were conducted with each athlete to enquire about return to sport and time lost in sport due to the knee injury. Factors associated with return to sport were investigated using statistical tests of association.

Results: Soccer was found to be the most common sport associated with knee injuries accounting for 30.6% of the injuries followed by kabaddi (20.9%). The most common mechanism was non-contact injury (64.4%). Competitive injuries were found to be significantly more than practice/training injuries ($p < 0.0001$). The most common injuries noted were ACL tears ($n = 314$) followed by meniscus injuries ($n = 284$) and the most common combination of injuries were an ACL tear with medial meniscus tear ($n = 163$). Only 39.8% of the athletes returned to sport. Mean duration of time lost in sport among those who returned to sport was 8.84 months. Return to sport was significantly associated with body mass index, level of competitiveness of the athlete and type of management ($p = 0.017$, 0.045 and < 0.0001 , respectively).

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Conclusion: Knee injuries take a huge toll on an athlete's career as observed in this study. Prevention of knee injuries is of paramount importance and more focussed epidemiological studies are needed for formulating policies to prevent sports injuries in both professional and amateur athletes.

Level of evidence: IV.

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1. Introduction

The commonest injuries in sports are musculoskeletal injuries comprising 80% of injuries in sports.^{1,2} Joint injuries, especially of the knee, make up a significant percentage of injuries in all sportsmen, both professional and recreational. Not only can a knee injury require surgery followed by long period of rehabilitation, but permanent disability related to both sport and work may be the outcome as documented by Kujala et al.³

In spite of the high frequency and morbidity of knee injuries in athletes, there are no studies from India focussing on the epidemiology of knee injuries in sportspersons, although, on the other hand, substantial research exists in the western literature regarding the same.^{1-5,7-12} The aim of this study was to study the frequency of different knee injuries in various sports in the Indian scenario and to assess factors that may affect return to sport. These data are important to formulate guidelines for the prevention and treatment of knee injuries in sports.

2. Materials and methodology

This study was a cross-sectional study conducted at the sports injury clinic, Post Graduate Institute of Medical Education and Research, Chandigarh, India. Being a specialised clinic in a referral centre, we receive a lot of sports injuries. The study was conducted over a 5-year duration from December 2009 to September 2014.

2.1. Selection criteria

Inclusion criteria were any sportsperson aged between 16 and 45 years who sustained a menisco-ligamentous injury to the knee while participating in a sporting activity either during a game or during training. Injuries sustained by a sportsperson in a non-sports setting were excluded. Athletes with other injuries to the knee, like patellofemoral pain syndrome, chondral injuries, extensor mechanism injuries, minor injuries, etc., were left out. Those athletes whose data were incomplete or those whom we could not contact over the telephone to enquire details about return to sport and time lost in sport were similarly excluded.

2.2. Data extraction and synthesis

Data were collected using standardised data collection cards, which have been maintained at our sports injury clinic since its inception. The data in these cards were pooled and analysed for demographic details like age, sex, height, weight,

body mass index (BMI) and for injury-specific features like mechanism of injury, duration of injury at presentation, injury pattern and type of management (surgical/conservative).

Athletes were classified into 2 categories, professional and amateur, depending on the level of their playing field. Any athlete representing a professional club/city/state/national team was considered as a professional athlete. On the other hand, any athlete playing the game at an inter-collegiate level or for recreational purposes was considered as an amateur athlete for the purpose of this study. In addition, the scenario in which the injury occurred was also enquired – whether the injury occurred during a competitive game or during practice/warm-up sessions.

Return to sport (at the same level in which the athlete was competing earlier) and time lost in sport as a consequence of the knee injury were assessed by contacting each athlete individually. Those athletes who did not respond to calls and those who were not willing to share details were excluded from the study.

During the time period of this study, 912 athletes presented to us for consultation for various injuries, out of which 465 athletes had knee injuries. After applying the selection criteria described above and conducting telephonic interviews with athletes to enquire about return to sport, 363 athletes were left, who were included for the final data analysis (see Fig. 1).

3. Results

3.1. Demographic details

Among the 363 players, 337 were males and 26 were females. All these athletes hailed from northern India, mainly from the states of Punjab, Chandigarh, Haryana and Himachal Pradesh with few players from Uttar Pradesh, Jammu and Kashmir, Rajasthan, Uttarakhand and Bihar. Right knee was more commonly affected ($n = 198$) than the left knee ($n = 165$). Mean height of the sportsperson was 1.77 m and mean weight was 76.76 kg. The mean BMI of the athletes was 25.97 with 66.5% of the athletes having a BMI less than 25.

3.2. Sports-wise distribution

The sports-wise distribution of these athletes is summarised in Table 1. Soccer was the most common sport associated with knee injury accounting for 30.6% of the injuries ($n = 111$) followed by kabaddi, a popular Indian rural sport ($n = 76$), accounting for 20.9% of the injuries. These were followed by athletics ($n = 34$), cricket ($n = 28$), volleyball ($n = 28$) and basketball ($n = 22$).

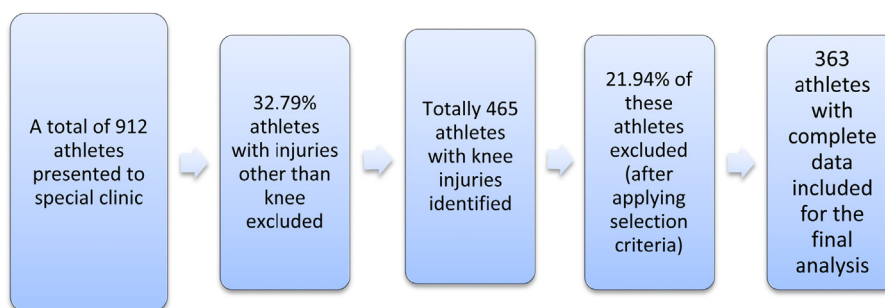


Fig. 1 – Flowchart depicting the cases included in this study.

Table 1 – Sports-wise distribution (in alphabetical order) of players and the distribution of various injuries among these athletes.

| Sport | No. of players | ACL injuries (Complete and partial tears) | Meniscal injuries (MM & LM) | Collateral ligament injury (MCL & LCL) | PCL injury |
|--|----------------|---|-----------------------------|--|------------|
| Athletics | 34 | 29 | 24 | 17 | 2 |
| Badminton | 8 | 7 | 4 | 3 | 0 |
| Basketball | 22 | 21 | 17 | 7 | 0 |
| Boxing | 2 | 2 | 2 | 0 | 0 |
| Cricket | 28 | 25 | 26 | 12 | 0 |
| Gymnastics | 2 | 1 | 3 | 0 | 0 |
| Handball | 5 | 3 | 5 | 1 | 0 |
| Hockey | 8 | 6 | 8 | 5 | 0 |
| Kabaddi | 76 | 68 | 52 | 28 | 5 |
| Lawn tennis | 1 | 1 | 2 | 1 | 0 |
| Long jump | 8 | 5 | 6 | 1 | 0 |
| Martial arts (Judo, Karate, Taekwondo) | 13 | 12 | 10 | 7 | 0 |
| Pole vault | 1 | 1 | 1 | 0 | 0 |
| Rowing | 1 | 1 | 1 | 0 | 0 |
| Shot put | 1 | 1 | 0 | 0 | 0 |
| Soccer | 111 | 95 | 90 | 37 | 3 |
| Squash | 2 | 2 | 2 | 0 | 0 |
| Table tennis | 1 | 1 | 0 | 0 | 0 |
| Tug of war | 1 | 1 | 2 | 0 | 0 |
| Volleyball | 28 | 23 | 26 | 8 | 0 |
| Weightlifting | 2 | 2 | 0 | 1 | 0 |
| Wrestling | 8 | 7 | 3 | 5 | 0 |
| Total | 363 | 314 | 284 | 133 | 10 |

MM, medial meniscus; LM, lateral meniscus; MCL, medial collateral ligament; LCL, lateral collateral ligament; PCL, posterior cruciate ligament.

3.3. Mechanism of injury

Non-contact mode of injury was most commonly observed and accounted for 64.4% of the injuries (n = 233). Contact injury accounted for the other 35.6% with direct contact mode in 24% of the injuries (n = 87) and indirect contact mode for 11.6% (n = 42). In one athlete, the mode of injury was uncertain.

3.4. Duration of injury at first presentation and injury scenario

The mean duration of injury prior to presentation at our clinic was 6.15 months (range: 1 week to 7 years). Injury occurrence during match time was 77.69% (n = 282) and during practice sessions it was 22.31% (n = 81).

3.5. Level of competitiveness of athlete

Amateur athletes comprised 58.1% of the athlete population (n = 211) and professional athletes accounted for the rest 41.9% of the population (n = 152).

3.6. Injury pattern

Anterior cruciate ligament injury was the most common injury and was noted in 86.5% of knee injuries (n = 314; complete ACL tear-287 and partial ACL tear-27). Meniscal injury (both medial and lateral) was noted in 284 knees and was the second most common knee injury seen in 78.24% of the knee injuries. Medial meniscus injury was more common among the two, being noted in 195 knees (53.72%) and lateral meniscus injuries

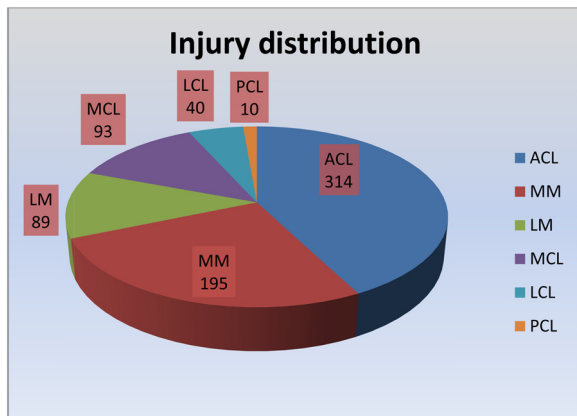


Fig. 2 – Pie chart depicting the distribution of various knee injuries seen in the athletes.

in 89 knees (24.52%). Collateral ligament injuries were noted in 133 knees with MCL injury seen in 25.62% of the knees ($n = 93$) and LCL injuries were seen in 11.01% ($n = 40$). Posterior cruciate ligament injuries were the least observed injuries accounting for 2.76% of the injuries ($n = 10$). These injuries occurred in varying combinations and the most common combination of injuries was ACL injury with medial meniscus tear seen in 45.2% of the population ($n = 163$) (Fig. 2).

3.7. Type of management

Arthroscopic surgical management was performed in 69.6% of the cases ($n = 252$) whereas 111 patients were treated conservatively by bracing and/or physiotherapy protocols. Among these patients, 14 athletes chose to undergo surgery at a different centre after initial consultation in our clinic due to long waiting lists.

3.8. Return to sport

Two hundred and fifteen athletes did not return to the sport, which comprises 60.2% of the population, whereas 142 athletes (39.8%) did return to their original sport. In 6 athletes, return to sport could not be commented upon as they were still undergoing rehabilitation.

BMI of athletes was significantly associated with the chances of return to sport. Athletes with a BMI <25 were significantly more likely to return to sport (106/239 athletes, i.e. 44.4% of athletes with normal BMI) than those athletes with a BMI more than 25 (34/110 athletes, i.e. 30.9% of athletes with BMI >25 ; $p = 0.017$). Professional athletes were significantly more likely to return to sport than amateur athletes ($p = 0.045$). Among professional athletes, 45.8% returned to sports ($n = 68/148$), whereas among amateurs, 35.4% returned to sport ($n = 74/209$).

Among athletes who returned to sport, 83.1% ($n = 118/142$) were managed surgically and 16.9% ($n = 24/142$) were treated conservatively. This observation was statistically highly significant ($p < 0.0001$). Age, gender, mechanism of injury, injury scenario, duration of injury at presentation and injury pattern were not associated with return to sport.

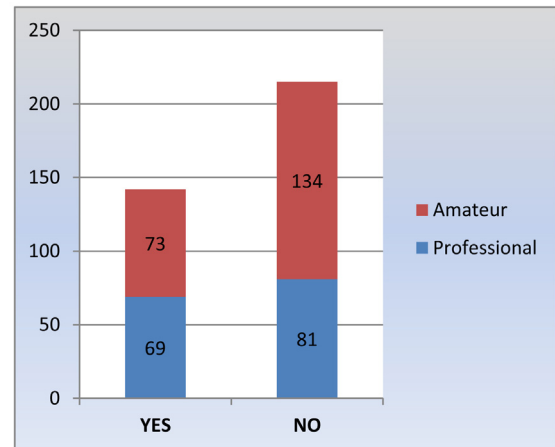


Fig. 3 – Bar graph depicting number of athletes returning to active sports in both amateur and professional athlete groups.

On comparison across different sports with a sample size of 20 or more, it was noted that volleyball had the highest return to sport (48.1% of all volleyball players) followed by kabaddi (42.1% of all kabaddi players), basketball (40.9% of all basketball players), soccer (38.3% of soccer players) and cricket (35.7% of cricketers). Athletics category had the lowest rate of return to sport (23.5%) (Fig. 3).

3.9. Time lost in sport

Among the 142 athletes who returned to active sports, the mean duration of time lost in active sports was 8.84 months.

4. Discussion

Participation in sports in India continues to increase with an expectant surge in the number of sports-related injuries. Knee injuries impose serious physical, psychological and economic burdens on sportspersons.

The population in our study is diverse, as athletes participating in 24 different sport modalities from 9 major states of northern India took part in this study. The study population was predominantly male dominated, which probably reflects the largely prevalent gender bias in sports participation in our country. Soccer, kabaddi, athletics, volleyball, cricket and basketball (in the same order) accounted for bulk of the knee injuries. We observed that the most common mechanism of injury is the non-contact mechanism of injury accounting for 64.4% of the injuries. Competitive activities were more likely to produce knee injuries than training activities ($p < 0.0001$), which is in accordance with other studies.^{4,5}

The mean duration between injury and presentation in our clinic was 6.15 months; this is on the higher side, as our hospital is a tertiary care referral centre. Probably for the same reason, the most common injury noted was the ACL tear accounting for a whopping 86.5% of the injuries followed by meniscal injuries (78.24%; $n = 284$). Individually, medial

meniscus tears were 2.2 times more common than the lateral meniscus tears and the most common associated injury with ACL tears.

Only 39.8% of athletes returned to sport; this is a very low percentage and reflects the devastating effect of knee injuries on a sportsperson's career. Among those who returned to sport, the mean duration of time lost in sport was 8.84 months. Return to sport was significantly more in professional athletes compared to recreational athletes ($p = 0.045$), which is possibly due to a higher degree of commitment to treatment and rehabilitation protocols. Athletes with a BMI less than 25 were noted to be more likely to return to their sport than those with a BMI more than 25 ($p = 0.017$).

The most significant factor associated with return to sport, however, was the type of management. Those treated surgically were more likely to return to sport than those treated conservatively ($p < 0.0001$). However, those with higher grade of injuries were more likely to get operated than those with lower grade of injuries with a resultant bias. Also, most of the athletes who were treated conservatively were those who refused surgery due to their personal preferences and were possibly not as determined to return to sport as the other lot anyway.

To the best of our knowledge, this is the first epidemiological study on sports-related knee injuries among Indian sportspersons. We, however, do acknowledge the limitations of this study. Some inherent weaknesses associated with the design of a cross-section study are inevitable and hence it is impossible to completely rule out bias in the study population. Also, 29.4% of athletes with knee injuries ($n = 102$) were excluded due to incomplete data, which adds to this inherent selection bias. Nevertheless, when cross-sectional studies/observational studies provide the only data available, it can make a significant impact on clinical practice.⁶

Being a hospital-based study, we were not able to calculate the actual on-site incidence rates of different injuries in various sports. Also, the sample sizes in 15 sports modalities were less than 10 each and hence it was impossible to conduct sub-group analyses in these individual categories.

In order to progress beyond these limitations, we need multi-centre, prospective studies with larger populations in the future. Ideally, these studies should be conducted in different professional sports leagues, sports academies, colleges, etc. to better define the incidence rates and risk factors of different knee injuries in various sports. Preventive measures effectively decrease the level and incidence of sports-related injuries.⁷⁻¹⁰ We can look forward to formulating policies to prevent and reduce the burden of sports-related injuries in athletes only if we create a sound epidemiological database.

5. Conclusions

Knee injuries, especially ACL tears, are a potentially devastating problem among athletes and impose substantial time loss

in a player's career and financial burdens on athletes' families and the healthcare system.¹¹ Injury prevention strategies should continue to be a high priority given the findings of this study in order to reduce the incidence and severity of knee injuries among Indian athletes.

Conflicts of interest

The authors have none to declare.

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