The Achilles Tendon Rupture in Basketball: Systematic Review of the Present Literature

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Currently, according to data from the Federation of International Basketball Associations (FIBA), more than 450 million people in the world practice basketball, thus ranking among the five most popular sports on the planet.

Basketball in Spain is the second most popular team sport as the most federated after football. There are 3,619 clubs with 385,100 licenses of which 36% correspond to women and 66% to men. Spain ranks as the second-best national

**Abstract**

**Background** The most common cause of the Achilles tendon ruptures in the U.S. population is sports, basketball is one among them. It is not one of the most frequent injuries of this sport, but it is one of the most serious and impactful in its practice.

**Purpose** The objective of this work is to gather evidence and evaluate the relationship between Achilles’ tendon ruptures and basketball.

**Study Design** This study designed as a systematic review.

**Material and Methods** A search of literature in the databases PubMed, Cochrane Library, and ClinicalTrials.gov was conducted during January and February 2020.

**Results** After the search and selection, three relevant articles were obtained due to their epidemiological content, Raikin et al and Lemme et al. In 2013 and 2018, they, respectively, conducted studies in U.S. populations, establishing sport as the most frequent injury mechanism in Achilles’ tendon ruptures. It was analyzed according to injury mechanism, gender, body mass index (BMI), and age. In both studies, the lesion resulted more frequently in men and the sport involved in most of the cases was basketball (32 and 42.6%, respectively). In 2019, Lemme et al published an epidemiological design analyzing the Achilles tendon ruptures in the National Basketball Association (NBA), identifying risk factors and results in professional players. After suffering the injury, 36.8% of the patients had to retire or were holders in less than 10 games to the rest of their sports career.

**Conclusions** The relationship between basketball and Achilles’ tendon rupture is clear in the general population. Despite this, new studies are required to complement the evidence obtained so far.
team in the FIBA World Ranking after the United States in men, and third after the United States and Australia in women.\(^1\)

The most frequent injuries in the practice of this sport are those of hands and shoulders in upper limbs, along with ankles and knees in lower limbs. The Achilles tendon rupture does not stand out for its frequency, but rather for its severity, making it impossible for 20.5% of those affected to return to the usual practice of basketball in the case of professionals.\(^3\)

Sports activity is the most frequent cause of Achilles tendon rupture. In the United States, basketball is the sport in which the injury in question most frequently occurs, while in Europe it is soccer.\(^3\)

It occurs more frequently in adults under 55 to 60 years of age and is related, in most cases, to basketball. This makes it responsible for 48% of the ruptures related to sports, and 32% of all ruptures according to Raikin et al.\(^4\) It has also been related to gender, body mass index (BMI), ethnicity, and both the practice of professional and amateur sports.\(^4\)

The objective of this work is to assess the relationship between Achilles’ tendon ruptures and basketball.

**Material and Methods**

This systematic review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines using a PRISMA checklist. Neither protocols nor registration have been assessed.

During January and February of 2020, a literature search was conducted on the prevalence of Achilles tendon rupture in basketball. Multiple databases were used such as PubMed, Cochrane Library, and ClinicalTrials.gov. The electronic search strategy used was “Achilles’ tendon rupture and basketball.” Studies were screened by title and/or abstract to determine study eligibility based on inclusion criteria. The inclusion criteria were descriptive epidemiology studies that described prevalence of Achilles’ tendon rupture in professional or amateur basketball players.

We have considered the following as inclusion criteria: all those published articles that contain the keywords, with data that highlight the relationship between the Achilles rupture and basketball. Exclusion criteria include systematic review articles, case reports, series where sport was not listed and where basketball was not included, series that did not present epidemiological data, and articles published in languages other than English or Spanish.

After the search, 24 results were found that were filtered according to the year of publication. The literature review shows an increase in publications from the year 2013 compared with the limited publication of studies in previous years. It was then decided to apply, saying year as a temporary filter obtaining 13 articles. Subsequently, the resulting articles were evaluated by title and abstract without considering the type of study, outcomes, gender, and/or interventions performed. Subsequently, 10 articles discussing other topics, such as treatment or prognosis of the injury, were excluded.

Finally, the following three articles were selected for their epidemiological content of relevance. First, “Epidemiology and Video Analysis of Achilles Tendon Ruptures in the National Basketball Association” of Lemme et al\(^5\) published in August 2019 by The American Journal of Sports Medicine. Second, “Epidemiology of Achilles Tendon Ruptures in the United States” of Lemme et al\(^3\) published in November 2018 by Orthopedic Journal of Sports Medicine. And finally, “Achilles Tendon Injuries in a United States Population” by Raikin et al\(^4\) in April 2013 in Foot & Ankle International magazine.

The three above are descriptive epidemiology studies with good quality assessment by the National Institute of Health (NIH) quality assessment tool (\(\text{Table 1}\)).

| Authors (year) | Quality rating |
|---------------|----------------|
| Lemme et al\(^3\) (2019) | Good |
| Lemme et al\(^3\) (2018) | Good |
| Raikin et al\(^4\) (2013) | Good |

The search and selection are detailed in \(\text{Fig. 1}\). Independent data collection process was conducted.

**Results**

After the search and selection, three articles were obtained, all of the epidemiologically descriptive designs\(^1\)–\(^5\) are presented in \(\text{Table 2}\) with a summary of the most relevant aspects. Only the study by Lemme et al, published in 2019, specifically deals with the Achilles tendon rupture in basketball, specifically in the National Basketball Association (NBA) of the United States.

The 2018 study by Lemme et al\(^5\) and the 2013 study by Raikin et al\(^4\) were included because of their epidemiological relevance and relationship to sport, specifically basketball.

The study by Lemme et al\(^2\) determined the incidence and risk factors of the Achilles tendon ruptures in the United States. Patients registered in the National Electronic Injury Surveillance System (NEISS) database, who came to the emergency department with this lesion between 2012 and 2016, were selected. The incidence was calculated according to the following variables: gender, age, race, and analyzing other variables such as the location where the injury occurred. Likewise, cases were classified according to the mechanism of injury, performing a subanalysis of injuries with sport. A significant increase in incidence was detected from 2012 with 1.8 cases per 100,000 person-years to 2016 with 2.5 cases per 100,000 person-years (\(p < 0.01\)), and a global incidence of 2.1 per 100,000 person-years. Of the 32,906 cases, 77.1% affected were men while the remaining 22.9% affected were women. The greatest increase in cases occurred in female patients between 40 and 59 years of age (78% of the increase). The most common injury mechanism detected was participation in sports or leisure activities (81.9%), with basketball being the most frequent cause...
Fig. 1 PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram.

Table 2 Epidemiological designs

| Authors (year) | Participants | Source | Incidence | Total cases |
|----------------|--------------|--------|-----------|-------------|
| Lemme et al\(^a\) (2019) | National Basketball Association players between the 1969 to 1970 and 2017 to 2018 seasons | Public data obtained from injury records, press communication, and player profiles | 0.92 per 450 people-year\(^a\) | 44 cases between the 1969 to 1970 and 2017 to 2018 seasons |
| Lemme et al\(^b\) (2018) | 1.6 billion people-year at risk between 2012 and 2018 | National Electronic Injury Surveillance System (NEISS) | 2.1 per 100,000 people-year | 32,906 cases between 2012 and 2016 42.6% of the total related to basketball |
| Raikin et al\(^c\) (2013) | Patients who visit an orthopaedic clinic in need of tertiary attention with diagnostic and surgical treatment of a torn Achilles’ tendon between August of 2000 and December of 2010 | International Classification of Diseases ninth edition code for the Achilles tendon rupture in Misys Healthcare Systems software | 2.66 per 1,000 people-year\(^b\) | 406 cases between August 2000 and December 2010 32% of the total related to basketball |

\(^a\)Calculated in a population at risk of 450 players/sports season.

\(^b\)According to data from Moller et al in 2001\(^d\) included in the study.
among all (42.6%), followed by American football (9.9%), tennis (6.9%), and athletics/climbing/stretching (5.8%).

Raikin et al reviewed 406 cases of the Achilles tendon rupture in the U.S. population. Patients who attended a tertiary care orthopaedic clinic with diagnosis and surgical treatment of the Achilles tendon rupture, between August 2000 and December 2010, and registered in the International Classification of Diseases 9th edition code for Achilles’ tendon rupture in Misys Healthcare Systems software were selected. Patients >55 years of age and with BMI >30 kg/m² were more likely to rupture the Achilles tendon in non-sport activity and more likely to have an initial misdiagnosis. Likewise, it was established that age and BMI were directly related to the time of diagnosis of the lesion. Of the 406 cases, 83% affected were men while 17% were women. Sports activity was responsible for 68% of injuries, in patients <55 years of age with 77% of injuries compared with 42% in patients >55 years of age. Basketball was the most involved sport, being responsible for 48% of the breaks related to the sport, and 32% of the total ruptures of the Achilles tendon. This is followed by tennis (13 and 9%) and football (12 and 8%). Other sports such as squash, volleyball, or soccer accounted for 31% of total injuries and 46.5% of those related to sports.

The distribution by sport of the above-mentioned studies is detailed in Fig. 2.

In August 2019, Lemme et al published a study based on epidemiology and video analysis of the Achilles tendon ruptures in the NBA, the American men’s professional basketball league. The objective of this descriptive design was to identify risk factors for the Achilles’ rupture in professional players of the best basketball league in the world, identifying cases from available public data on injury reports, press releases, and player profiles. Video analysis was used to identify the mechanisms of injury and the most frequent game situations where such injuries occurred. In 48 years, 44 players had Achilles’ tendon ruptures. The average age of the injured players was 28.3 years with an average of 6.8 seasons played in the league. A higher prevalence was seen at the beginning of the season (27.3%), followed by the preseason (18.2%) and the end of the season (18.2%). The average recovery time was 10.5 months. In more than one-third of the cases (36.8%), the patients had to retire or were holders in less than 10 games to the rest of their sports career. The video analysis available in 12 cases showed that the injuries occurred without contact. The most frequent mechanism of injury was the beginning of the action starting from the resting position, with dorsiflexion of the foot, early knee flexion, and hip extension. In addition to age and time of the season, other characteristics of the lesion present in Table 3 were analyzed.

Discussion

This review investigated the relationship between Achilles’ tendon rupture and basketball. Numerous works coincide in the increase in Achilles’ tendon ruptures in recent decades, assuming an incidence between 8.3 and 24 per 100,000 person-years in the general population. It is necessary to highlight that the samples of the studies analyzed in this

![Fig. 2](image-url) Percentage of sports injuries according to the sport performed on the total Achilles tendon tears.
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Table 3 Characteristics of the lesions analyzed of the 44 National Basketball Association players injured by Lemme et al in 2019

| Variable                        | Category | Percentage of injury (n) |
|---------------------------------|----------|--------------------------|
| Laterality of the injury        | Right    | 50 (21)                  |
|                                 | Left     | 50 (21)                  |
| Age (y)                         | <30      | 68.2 (30)                |
|                                 | >30      | 31.8 (14)                |
| BMI                             | <25      | 40.9 (18)                |
|                                 | ≥25      | 59.1 (26)                |
| Field position b                 | 1–3      | 31.8 (14)                |
|                                 | 4–5      | 68.2 (30)                |
| Place of injury                 | Game     | 78.3 (29)                |
|                                 | Practice | 21.7 (8)                 |
| Point in the season             | Out of season | 15.9 (7)             |
|                                 | Preseason | 18.2 (8)                 |
|                                 | Start of season | 27.3 (12)          |
|                                 | Midseason  | 15.9 (7)                 |
|                                 | End of season | 18.2 (8)            |
|                                 | Postseason | 4.5 (2)                  |
| Seasons played after recovery   | 0c       | 20.5 (9)                 |
|                                 | 1 season  | 15.9 (7)                 |
|                                 | ≥2 seasons | 63.6 (28)            |

Abbreviation: BMI, body mass index.

Identified in 37 cases (84.1%).

Table 4 Gender distribution of Achilles’ tendon tears

| Authors (year) | Gender | Percentage of Injury (n) |
|----------------|--------|--------------------------|
| Raikin et al4 (2013) | Masculine | 83 (331) |
|                | Feminine | 17 (69) |
| Lemme et al5 (2018)  | Masculine | 77.1 (25,374) |
|                | Feminine | 22.9 (7,533) |

According to Parekh et al in the National Football League (NFL), there were 31 cases of the Achilles tendon rupture in the league over a period of 5 years (1997–2002). This data are unquestionably superior to that of the NBA, where in 48 years, there were only 44 cases. Therefore, it is essential to differentiate Achilles’ tendon ruptures in amateur players compared with professionals in basketball and other sports.

In the NBA in 48 years, there have been only 44 cases of the Achilles tendon ruptures. The average age of the injured is 28.3 years with a higher prevalence of injuries in players with BMI > 25 kg/m². Precisely, the age between 28 and 32 years is when players assume their highest level of sports performance. Injuries occur mostly at the beginning of the season (27.3%) and in matches (78.3%). It is a more frequent injury in players of the power forward and center positions (68.2%), and according to Amin et al, with an average height of 200 cm (between 180.0 and 221.0).

In case of return to the sport, the average recovery time is 10.5 months. However, in 36.8% of the cases, the players retire or are holders in less than 10 games to the rest of their sports careers. In 20.5% of the cases, the players are forced to withdraw when they suffer this injury. Also, 15.9% will play only one more season after their recovery, and the rest will play two or more seasons after recovery (63.6%). Therefore, in professional basketball, the Achilles tendon rupture is not frequent but is an extremely serious injury.

Despite the above data, although there is sufficient evidence of the relationship between basketball and Achilles’ tendon rupture, we are surprised by the low number of articles published globally, in relation to the number of cases that occur worldwide. Even establishing a clear relationship between basketball and injury, more studies are needed in both amateur and professional basketball players and in both genders.

Conclusion

The relationship between Achilles’ tendon rupture and basketball is clear. While among sports, at the population level, the most frequent injury mechanism is basketball, and at the professional level, there are uncertain results. Therefore,
there is not enough evidence to determine the relationship between this sport and the injury in question, and further studies (both professional and amateur and in both genders) are needed to determine this.

Conflict of Interest
The authors report no conflict of interest.

References
1 FIBA Basketball. Presentación. Accessed June 24, 2021 at: http://www.fiba.basketball/es/presentation
2 Annual Report 2018-Licenses and Federated Clubs. Ministry of Culture and Sports. Government of Spain Accessed in February 2020 at: https://www.csd.gob.es/sites/default/files/media/files/2019-07/Licenses_y_Clubes_2018_0.pdf
3 Lemme NJ, Li NY, Kleiner JE, Tan S, DeFroda SF, Owens BD. Epidemiology and video analysis of Achilles tendon ruptures in the National Basketball Association. Am J Sports Med 2019;47 (10):2360–2366
4 Raikin SM, Garras DN, Krapchev PV. Achilles tendon injuries in a United States population. Foot Ankle Int 2013;34(04):475–480
5 Lemme NJ, Li NY, DeFroda SF, Kleiner J, Owens BD. Epidemiology of Achilles tendon ruptures in the United States: athletic and nonathletic injuries from 2012 to 2016. Orthop J Sports Med 2018;6(11):232596711880238
6 Moller M, Movin T, Granhed H, et al. Acute rupture of tendon Achilles: a prospective randomised study of comparison between surgical and non-surgical treatment. J Bone Joint Surg Br 2001;83 (06):843–848
7 Gwynne-Jones DP, Sims M, Handcock D. Epidemiology and outcomes of acute Achilles tendon rupture with operative or nonoperative treatment using an identical functional bracing protocol. Foot Ankle Int 2011;32(04):337–343
8 Houshian S, Tscherning T, Riegehs-Nielsen P. The epidemiology of Achilles tendon rupture in a Danish county. Injury 1998;29(09):651–654
9 Leppilahit J, Puranen J, Orava S. Incidence of Achilles tendon rupture. Acta Orthop Scand 1996;67(03):277–279
10 Maffulli N, Waterstone SW, Squair J, Reaper J, Douglas AS. Changing incidence of Achilles tendon rupture in Scotland: a 15-year study. Clin J Sport Med 1999;9(03):157–160
11 Nyyssonen T, Luthje P, Kroger H. The increasing incidence and difference in sex distribution of Achilles tendon rupture in Finland in 1987–1999. Scand J Surg 2008;97(03):272–275
12 Pajala A, Kangas J, Ohtonen P, Leppilahit J. Rerupture and deep infection following treatment of total Achilles tendon rupture. J Bone Joint Surg Am 2002;84-A(11):2016–2021
13 Suchak AA, Bostick G, Reid D, Blitz S, Jomha N. The incidence of Achilles tendon ruptures in Edmonton, Canada. Foot Ankle Int 2005;26(11):932–936
14 White DW, Wenke JC, Mosely DS, Mountcastle SB, Basamania CJ. Incidence of major tendon ruptures and anterior cruciate liga- ment tears in US Army soldiers. Am J Sports Med 2007;35(08):1308–1314
15 Parekh SG, Wray WH, Brimmo O, Sennett BJ, Wapner KL. Epidemiology and outcomes of Achilles tendon ruptures in the National Football League. Foot Ankle Spec 2009;2(06):283–286
16 Amin NH, McCullough KC, Mills GL, et al. The impact and functional outcomes of Achilles tendon pathology in National Basketball Association players. Clin Res Foot Ankle 2016;4(03):205