

Achilles Tendon Rupture in Professional Football Player: an Epidemiological Study in European Championship With A Mid-Term Follow-Up

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SUMMARY

Background. To evaluate the role of age in Achilles tendon rupture (ATR) and the impact of ATR on professional football (soccer) players. The data considered were age, body mass index (BMI), position, injury history, affected side, return to play (RTP) rate and time and percentage of played minutes per season (MPS) for the two pre-injury and two post-injury seasons. The level of play, occurrence of re-ruptures and retirement from football were recorded.

Methods. Professional male football players who suffered an ATR between 2010 and 2020 were included. Data were retrieved through the publicly available media-based platform Transfermarkt. Missing data were searched for through other publicly available sources.

Results. In all, 55 players out of 77 satisfied the inclusion criteria. The mean age at the time of injury was 28.7 ± 4.1 years (range, 19–39). The RTP rate was 92.7%, and the mean RTP time was 209 ± 65 days (range, 116–418 days). Four players retired after the injury. Six players sustained an Achilles tendon re-rupture at a mean of 5.45 ± 2.8 years follow-up, and six players did not maintain the same level, instead playing in lower categories. The mean pre-operative MPS was $56\% \pm 24\%$ and $49.5\% \pm 27.7\%$ two and one season, respectively, before the injury. The mean MPS decreased to $36.1\% \pm 23.2\%$ and $39.3\% \pm 24.2\%$ in the first and second post-injury seasons, respectively.

Conclusions. Players' performance in terms of MPS showed a decrease in the two seasons following the injury. Players' ages influenced the differences in terms of MPS between the seasons analysed and correlated significantly with retirement from professional football.

KEY WORDS

Achilles tendon rupture; football; football players; performance; return to play.

INTRODUCTION

Achilles tendon rupture (ATR) occurs most frequently during participation in sports, especially football, tennis, and basketball (1, 2). Sports that involve frequent acceleration and changes of direction with excessive eccentric loads on the Achilles tendon (AT) are considered to

impose a high risk of ATR (3). The incidence of ATR in the general population ranges from 4.7 to 24 per 100,000 and has shown a consistent upward trend over a 15-year period and involvement of middle-aged people (4, 5). AT ruptures can be divided into acute, when diagnosed or treated within 6 weeks, or chronic (6, 7).

ATR in professional athletes can be a troublesome event and, in some cases, can be career ending, forcing them to undergo surgery to restore tendon anatomy, myotendinous junction length and maximal strength recovery (8, 9).

Some studies evaluated the epidemiology and clinical outcomes, particularly return to play (RTP), after different orthopaedic injuries, including ATR, in professional athletes of the National Basketball association (NBA) and National Football League (NFL) (8, 10). However, few studies have analysed the effect of ATR on professional football (soccer) players. Forlenza *et al.* (4) showed that soccer players who ruptured their AT had a 78% RTP rate at any timepoint, while Grassi *et al.* (11) found a return to unrestricted training after 7 months and to competition after 9 months.

The aim of this study was to evaluate the RTP rate and time after ATR, as well as outcomes after RTP in terms of player performance in the two post-injury seasons compared to the two pre-injury seasons. Moreover, an analysis of the re-rupture rate and player level after the injury was performed. Another aim of the study was to analyse the role of age in relation to ATR. The hypothesis of the study was that ATR and age influenced players' performance.

METHODS

In this retrospective study, the authors identified male professional football players who sustained an ATR in the period between 2010 and 2020. A search was conducted using the keywords "Achilles tendon rupture" and "Transfermarkt". Ethical approval was not sought for the present study as data were retrieved through the publicly available media-based platform.

Male professional football players who had an ATR in the period between 2010 and 2020 and belonged to the first team rosters of professional football teams at the time of injury were included. For the included players, age, BMI, position, injury history, affected side, RTP rate and time and percentage of played minutes per season (MPS) before and after ATR were retrieved from the publicly media-based platform Transfermarkt (www.Transfermarkt.com, GmbH & Co. KG, Hamburg, Germany). This is an online archive collecting every kind of data about football players, which has been used in previous similar papers. Missing data were searched for through other publicly available online sources, such as official team websites and press releases. The RTP rate was defined as the percentage of injured players who played at least one game at the professional level after ATR. The RTP time was assessed as the number of days from an ATR to the first match appearance with the first team, reserve team, youth team

or national team. Minutes per season (MPS) was defined as the percentage of minutes played of the total playable minutes during each season. The mean MPS was calculated for both the two pre-injury and the two post-injury seasons. In the first post-operative season, the rate of played minutes out of the total playable minutes since the RTP date was calculated. Data were also evaluated based on players' age (younger or older than the median age of the analyzed population of 28 years), position (goalkeeper, defender, midfielder, forward), affected side (dominant or not) and different leagues.

Players who transferred to a lower league or ended their career for any reason before the end of the second season were recorded. Downgrading of leagues was defined as being transferred to a lower competitive level according to the United European Football Association (UEFA) Country Ranking. Complications were defined as re-ruptures (ipsilateral or contralateral), re-operation or any adverse event occurring within the rehabilitation period resulting in a delayed or missed RTP.

Players were excluded from the MPS evaluation if they did not play two seasons before or after the injury or if data were not available.

Statistical analysis

All analyses were performed with SPSS® Statistics software (version 25.0; IBM SPSS, Armonk, NY). Descriptive data were analysed for the entire patient cohort. The level of statistical significance was set at $p < 0.05$. Descriptive data analyses were conducted depending on the nature of the considered criteria. For quantitative data, this included the number of observed values (and missing values, if any), mean, SD and median. For qualitative data, this included the number of observed and missing values and the number and percentage of patients per class. Comparisons between variables were assessed with a chi-square or Fisher's exact test for categorical variables and the Student's t-test or Wilcoxon test for quantitative variables. The normality of variables was assessed with a Kolmogorov-Smirnov test. The characteristics of the studied population were described according to the group (< 28 years old or ≥ 28 years old).

RESULTS

During the study period, 77 elite male football players sustained an Achilles tendon rupture requiring surgical treatment. Overall, 55 players satisfied the inclusion criteria, while 22 players were excluded due to inconsistent follow-up or insufficient available data. Of the players who had an adequate post-injury follow-up of ≥ 2 years,

four players (7.3%) retired after the injury. Demographic data are reported in **table I**. The mean age at the time of injury was 28.7 ± 4.1 years (range, 19–39). The injury occurred during matches in 74% of cases. Midfielders and defenders were more likely to be injured, with each category accounting for 36.4% of those injured.

The return to play rate was 92.7%, and the mean RTP time was 209 ± 65 days (range, 116–418 days). Six players (11.8%) out of 51 who returned to play sustained ipsilateral Achilles tendon re-rupture at a mean 5.45 ± 2.8 years follow-up. Six players (11.8%) out of 51 players did not maintain the same level of play and subsequently played in lower categories. The players' performances are displayed in **table II**.

No correlation was found between being downgraded and being older or younger than 28 years, the median of the study sample ($p = 0.7$). Age also did not correlate with the risk of re-rupture ($p = 0.2$) but did correlate significantly with retirement from playing professional football ($p < 0.001$).

The mean pre-operative MPS was $56\% \pm 24\%$ (range, 0.88%–98.3%) and $49.5\% \pm 27.7\%$ (range, 2.6%–99.4%) two and one season before the injury respectively. The mean MPS was $36.1\% \pm 23.2\%$ (range, 0.2%–88.5%) and $39.3\% \pm 24.2\%$ (range, 0.1%–84.5%) at one and two seasons post-operation, respectively. Comparisons between MPS through the studied seasons are presented in **table III**.

Age significantly influenced the differences in MPS between all the football seasons analyzed, before and after the injury (**table IV**).

Table I. Demographic data of the participants (n = 55).

Age, y	28.7 ± 4.1 (19-39)
Height (m)	1.82 ± 0.1 (1.65-1.91)
Weight (kg)	75.73 ± 6.8 (57-93)
Injured side	Right, 23 (41.8); Left, 32 (58.2)
Dominant side	Right, 46 (83.6); Left, 9 (16.4)
Position	
Goalkeeper	4 (7.3%)
Defender	20 (36.4%)
Midfielder	20 (36.4%)
Forward	11 (19.9%)
Injury	
Match	41 (74.5%)
Training	9 (16.4%)
Other/unknown	5 (9.1%)

Data are presented as mean \pm SD (range) or n (%).

Table II. Performance of the players who returned to play after Achilles Tendon injury (n = 51).

Return to play, days	209 ± 65 (116-418)
Achilles' tendon re-rupture	6 (11.8)
League downgrade	6 (11.8)

Data are presented as mean \pm SD (range) or n (%).

Table III. Comparison in terms of MPS between the football seasons included in the study.

	Mean	Standard Deviation	P-value
One season vs two season after injury	36.1	23.2	0.523
	39.3	24.2	
One season before injury vs one season after injury	49.5	27.7	0.009
	36.1	23.2	
One season before injury vs two season after injury	49.5	27.7	0.029
	39.3	24.2	
Two seasons before injury vs one season after injury	56	24	< 0.001
	36.1	23.2	
Two seasons before injury vs two seasons after injury	56	24	0.004
	39.3	24.2	

Values of the means and the standard deviations are expressed in %.

Table IV. Δ MPS between the football seasons included in the study, the comparison is made in respect of players < 28 years old vs \geq 28 years old.

		Mean	Standard deviation	P-value
One season before injury vs one season after injury	< 28 years old	0.51	30.6	0.006
	\geq 28 years old	-22	34.7	
Two seasons before injury vs one season after injury	< 28 years old	-11.4	34.1	< 0.001
	\geq 28 years old	-23.5	31	
One season before injury vs two season after injury	< 28 years old	-0.25	28.4	0.02
	\geq 28 years old	-18.3	35.7	
Two seasons before injury vs two seasons after injury	< 28 years old	-12.1	39.8	0.003
	\geq 28 years old	-19.7	34.1	

Values of the means and the standard deviations are expressed in %.

DISCUSSION

The main finding of the current study was that 92.7% of professional football players return to play after sustaining an ATR with a mean RTP time of 209 ± 65 days. Another important finding is that players' performances are different in the seasons after ATR compared to the pre-injury seasons. Moreover, the players' ages influenced the differences in terms of MPS between the seasons analysed and correlated significantly with retirement from professional football. These results support the initial hypothesis of the study.

This study also revealed that 11.8% of the included players did not maintain their previous levels, playing in lower categories after injury, and 11.8% of players who returned to played sustained an Achilles tendon re-rupture during their careers.

The present series found that professional football players who suffered an ATR had a mean age at the time of injury of 28.7 years, whereas other studies found mean ages of 27.49 and 27.2 years (4, 10). This may confirm how ATR could be considered an injury of the mature athlete (11).

In fact, ATR could be related to degenerative changes and overuse, and older age could be considered a risk factor for both, as demonstrated in previous studies (8, 13). This age is different from that reported for other typical football injuries, such as anterior cruciate ligament (ACL) tears, which have a mean age of 25.6 years, or femoro-acetabular impingement (FAI), which has a mean age of 25.0 years (14, 15).

In 74% of cases in this study, ATR occurred during matches. This could be due to the excessive stresses players are subjected to during matches compared to training. Recently, Grassi *et al.* (12) found a higher risk of ATR during games, especially in the second half, in a small group of football players. Regarding player position, a higher

percentage of ATR was found in defenders and midfielders in this study. A similar finding was reported in a previous study, where 74% of 132 professional football players with ATR were defenders and midfielders.

The mean RTP time in this study was 209 ± 65 days, which is higher compared with the 161 days of the study conducted by Gajhede-Knudsen *et al.* (16) The reported RTP finding is consistent with prior studies, which assessed that an ATR involves a relevant loss of play time. Forlenza *et al.* (4) found a mean RTP of 5.07 months, whereas in a study by Grassi *et al.* (11) the mean RTP was between 7 and 9 months. This investigation shows a RTP rate of 92.7% at any timepoint after the ATR, with 88.2% of players returning to pre-injury levels. This percentage closely agrees with that reported in a study by Vadalà *et al.* (17). They found that 91% of 36 professional athletes (25 football players) returned to the same level of play after a combined mini-open and percutaneous repair of the Achilles tendon. However, this RTP rate is greater than those found in NBA and NFL players, where only 68% and 65.5%, respectively, returned to their sport (18). In the present investigation no statistically, significant correlation was found between age and playing in a lower football league after the injury. The RTP rate reported is higher than in a systematic review by Zellers *et al.* (19), in which they evaluated a total of 108 studies and 6506 patients, reporting a RTP rate of 80%. However, they assessed how determination of the RTP rate could be subject to bias and different measures to define it. Moreover, they found that many studies did not explain how the RTP rate was calculated.

Regarding the rate of re-rupture and withdrawal from professional football, 6 out of 51 players (12%) included in the study suffered an Achilles tendon re-rupture at a mean of 5.45 ± 2.8 years follow-up, which is consistent with previous studies that reported re-rupture rates in elite

athletes ranging from 6% to 15% (3, 20). Four players retired from professional football after the injury. Age did not correlate with the risk of re-rupture, but the correlation with retirement was statistically significant.

The data collected on the performance of the players included in the study showed how MPS decreased in the two seasons after the injury compared to the previous ones. In fact, the average MPS was 56% and 49% two seasons and one season, respectively, before the ATR, decreasing to 36.1% and 39.3%, respectively, in the first and second season after surgery. However, a slight improvement in terms of MPS occurred in the second season after the injury compared to the first season. These differences in MPS were significantly influenced by age. A similar result was previously indicated in a study where two years post-operatively professional football players played 28.3% fewer minutes compared to the pre-injury season (20).

This investigation demonstrates how ATR is an injury that can seriously affect a professional football player's career. Overall, 88.2% of football players who suffered an ATR returned to the same pre-injury level two seasons later while having a decreased MPS.

The use of the available media-based platform Transfermarkt is the main limitation of this study. Although access to medical records, magnetic resonance images, and information on injury type, surgery and rehabilitation programs could have been more reliable, Transfermarkt has already been used in several studies to evaluate the epidemiology of various injuries in professional football players (15, 21). However, we evaluated Transfermarkt free from ascertainment bias because medical staff are not included in the collection and analysis of the data.

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CONCLUSIONS

ATR is a devastating injury for the career of a professional football player. In the current series, the RTP rate was 92.7%, and 88.2% returned to the same pre-injury level. The player's performance in terms of MPS shows a decrease in the two seasons following the injury. Moreover, the players' ages influenced the differences in terms of MPS between the seasons analysed and correlated significantly with retirement from professional football. These results confirmed the hypothesis of our study.

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None.

DATA AVAILABILITY

Data are available under reasonable request to the corresponding author.

CONTRIBUTIONS

All the authors were equally involved in the conception and design of the first draft. DM, AA, EM, GP, AF: conceptualization, design, and manuscript preparation. AA, SF, EV, SP, GR: data collection. AC, GR: data analysis and interpretation of data. All the authors have read and approved the final version of the manuscript.

CONFLICT OF INTERESTS

The authors declare that they have no conflict of interests.

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