Open Access Journal of Sports Medicine Dovepress

Open Access Full Text Article ORIGINAL RESEARCH

Achilles Tendon Pain in Male Professional Football Players - A Prospective Five-Season Study of 88 Injuries from the UEFA Elite Club Injury Study

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Purpose: The objective was to describe the location, examination procedures, diagnoses, and treatment for gradual-onset Achilles tendon pain in male professional football (soccer) players.

Patients and Methods: Forty-seven teams were followed prospectively for at least one season from 2013/14 to 2017/18. Time-loss injuries were recorded by the teams' medical staffs. For all non-contact Achilles tendon injuries, a specific Achilles tendon form was sent to teams.

Results: There were 88 time-loss injuries recorded with gradual-onset Achilles tendon pain amongst 72 players; 22 (25%) of them were severe lasting more than four weeks including one career-ending injury. The specific form was returned for 78 injuries (89%) with 55 cases (71%) having midportion and 23 cases (29%) insertional pain. There were 51 cases (65%) being examined with ultrasound and 29 cases (37%) with magnetic resonance imaging, both modalities being used in 18 cases (23%). Tendinopathy was the most frequently reported main diagnosis both for midportion and insertional pain with 60 cases (77%), but multiple diagnoses were recorded in 21 cases (27%). Surgery was performed in six cases (8%), and the majority of players were exposed to several non-surgical treatments in various combinations, with eccentric training and cryotherapy being most frequent with 52 cases (72%) each.

Conclusion: Tendinopathy was the most frequent diagnosis both for midportion and insertional pain. Imaging was carried out for most injuries. A majority of injuries were managed non-surgically, with eccentric training and cryotherapy being the most frequently applied treatments.

Keywords: athletic injuries, elite, imaging, rehabilitation, tendinopathy

Introduction

Muscle and tendon injuries dominate the injury landscape in men's professional football (soccer) players.[1,2] In the first decade of the 2000s, tendon injuries constituted around 7% of all time-loss injuries in male professional football (soccer) players, which corresponds to four time-loss tendon injuries per team and season on average.[2] Although almost any free tendon in the body can be affected, the Achilles and patellar tendons are among the most frequently encountered ones in terms of time-loss from football.[3–6]

Historically, there have been several inconsistencies in the classification and terminology used for tendon-related injuries and disorders.[7,8] Whereas the tendon rupture has an acute symptom onset with or without any prodromal symptoms, the tendinopathy is characterised by gradual symptom onset and reduced performance. Achilles tendinopathy is divided into midportion (2–7 cm from calcaneus) and insertional (0–2 cm from calcaneus).[7] In addition, other Achilles

Received: 30 August 2024
Accepted: 1 November 2024
Published: 9 November 2024

tendon-related conditions in the area include paratendinopathy, bursitis (superficial or retrocalcaneal) and calcaneal bone disorders like Haglund deformity and bone spurs.[7]

There are several treatment options available for midportion and insertional Achilles tendinopathy.[9] These treatments include non-surgical alternatives such as eccentric training and other loading regimens, shockwave therapy, laser therapy, and pharmacotherapy. When non-surgical treatment fails, there are also several surgical treatments described.[10,11] Overall, there is a gap in the literature on Achilles tendon injuries other than ruptures in football players, and the preferred treatments in professional players are unclear from the literature.[6]

Therefore, the objective of this prospective cohort study was to describe the location, examination procedures, diagnoses, and treatment for gradual-onset Achilles tendon pain in male professional football players.

Materials and Methods

This is a sub-study of a long-term prospective cohort study carried out in collaboration with the Union of European Football Associations (UEFA), the so-called UEFA Elite Club Injury Study (ECIS). As part of the general methodology, time-loss injuries have been collected monthly in men's professional football players since 2001.[12] For the purpose of this Achilles tendon pain sub-study, 47 teams with 2018 individual players from the highest national leagues in 19 European countries were followed for at least one season during five consecutive seasons spanning from July 2013 to May 2018. In total, data were collected from 153 team-seasons, with 15 teams participating in all five seasons (Table 1). The overall study methodology is only presented below in brief as this, and the definitions and the development of the study design have previously been reported in detail.[13] The overall study methodology also complied with the original consensus statement on definitions and data collection procedures in studies of football injuries.[14] The reporting of findings was also in line with the most recent consensus statements where applicable,[15,16] even if the data collection ended before these statements were published.

Table 1 Participating Teams in the UEFA Elite Club Injury Study 2013/14 to 2017/18

Team	2013/14	2014/15	2015/16	2016/17	2017/18
AC Milan	X	X		X	
AFC Ajax	X	X	X		
Arsenal FC	X	X	X	X	X
Bayer 04 Leverkusen	X	X	X	X	X
BVB Dortmund	X	X	X	X	X
Celtic FC	X			X	X
Chelsea FC	X	X	X	X	X
Club Brugge KV	X	X		X	X
FC Barcelona	X	X	X	X	X
FC Bayern München	X	X			X
FC Copenhagen	X			X	
FC Internazionale	X				
FC Porto	X	X	X	X	X
FC Schalke 04	X		X		
FC Shaktar Donetsk	X	X	X	X	X
Juventus FC	X	X	X	X	X
Liverpool FC	X	X		X	
Manchester City FC	X	X	X	X	X
Manchester United FC	X	X	X	X	X
Olympiacos FC	X				
Olympique de Marseille	X	X			
Panathinaikos FC	X				

(*Continued*)

Table 1 (Continued).

Team	2013/14	2014/15	2015/16	2016/17	2017/18
Paris Saint-Germain FC	X	X	X	X	X
PSV Eindhoven	X	X	X	X	X
Real Madrid CF	X	X	X	X	X
RSC Anderlecht	X	X		X	X
SL Benfica	X	X	X	X	X
SSC Napoli	X			X	X
Tottenham Hotspur FC	X	X	X	X	X
Athletic Club Bilbao		X		X	X
Club Atletico de Madrid		X	X	X	X
FC Basel 1893		X	X	X	X
FC Zenit		X	X	X	
Galatasaray AS		X	X	X	X
NK Maribor		X	X	X	X
Sporting Clube de Portugal		X	X	X	X
AS Roma			X	X	X
LOSC Lille			X	X	X
Olympique Lyonnais			X	X	
Valencia CF			X		
Maccabi Tel-Aviv FC			X		
PFC CSKA Moskva				X	X
Leicester City FC				X	
GNK Dinamo Zagreb				X	
APOEL FC					X
AS Monaco					X
Villarreal FC					X

Data Collection

All contracted players listed in the first team squads of participating teams were each season invited to participate with no exclusions (ie also injured players were invited, but the current injury was not counted). Players who left the team during the season for another team outside the study were only included for the period with the included team (ie injuries were not further recorded for players going on loan to or were permanently transferred to another team). Players who joined the team during the season from another team within or outside the study were offered inclusion as per routines at the start of the season. Baseline data regarding anthropometrics and leg dominance (defined as the preferred kicking leg) were collected each season at player inclusion. Playing exposure and time-loss injuries were recorded prospectively by the teams' medical staffs, usually the team physician(s) and/or the head physiotherapist, on standard forms that were sent to the study group via Email or an encrypted cloud service on a monthly basis. The general injury form provided information about the injury type, injury location, and circumstances of injury occurrence. When a non-contact Achilles tendon injury was reported as the main diagnosis on this general injury form, a sub-study specific injury form for Achilles tendon injuries was also sent to the teams' medical staffs. This specific form asked for the further injury-specific details being outlined in Table 2 and 3 (Supplementary File 1). Total ruptures with an acute symptom-onset were excluded in this report. The player was regarded as injured until the teams' medical staff allowed full participation in training and availability for match selection. All injuries were followed until the final day of rehabilitation.

Ethical Approval

The study design was reviewed and approved by the UEFA Medical Committee and the UEFA Football Development Division 21/06/2012. All players provided written informed consent at inclusion.

Table 2 Imaging, Main Diagnosis, Preceding Symptoms and Reasons for Time-Loss

	Total (n=78) n (%)	Midportion (n=55) n (%)	Insertion (n=23) n (%)
Imaging			
No imaging	18 (23)	14 (18)	4 (5)
US	30 (38)	21 (27)	9 (12)
MRI	11 (14)	6 (8)	5 (6)
US + MRI	17 (22)	13 (17)	4 (5)
X-ray + US	1 (1)	0	1 (1)
X-ray + US + MRI	1 (1)	1 (1)	0
Main diagnosis			
Tendinopathy	60 (77)	42 (54)	18 (23)
Paratendinopathy	13 (17)	10 (13)	3 (4)
Bursitis	2 (3)	0	2 (3)
Partial tendon rupture	2 (3)	2 (3)	0
Plantaris tendinopathy	1 (1)	1 (1)	0
Preceding symptoms			
1–7 days duration	27 (35)	22 (28)	5 (6)
8–28 days duration	10 (13)	7 (9)	3 (4)
>28 days duration	13 (17)	8 (10)	5 (6)
Reason for time-loss			
Unable to play	38 (49)	29 (37)	9 (12)
Safety precaution	29 (37)	21 (27)	8 (10)
Convenient gap in schedule	5 (6)	3 (4)	2 (3)
Surgery	6 (8)	2 (3)	4 (5)

Table 3 Non-Surgical Treatment Modalities Used in Players Not Undergoing Surgery

	Total (n=72) n (%)	Midportion (n=53) n (%)	Insertion (n=19) n (%)
Eccentric training	52 (72)	35 (66)	17 (89)[a]
Dorsiflexion > 90°	31 (43)	22 (42)	9 (47)
To the floor (90°)	20 (28)	13 (25)	7 (37%)
Concentric training	15 (21)	11 (21)	4 (21)
Static training	24 (33)	18 (34)	6 (32)
Balance training	24 (33)	19 (36)	5 (26)
Neuromuscular training	23 (32)	18 (34)	5 (26)
Flexibility training	37 (51)	29 (55)	8 (42)
Modified training/active rest	26 (36)	20 (38)	6 (32)
Shockwave treatment	20 (28)	11 (21)	9 (47)
Therapeutic ultrasound	31 (43)	21 (40)	10 (53)
Laser therapy	25 (35)	19 (36)	6 (32)
Manual therapy	33 (46)	25 (47)	8 (42)
Cryotherapy	52 (72)	40 (75)	12 (63)
Injection	11 (15)	10 (19)	1 (5)
Platelet-rich plasma	7 (10)	6 (11)	1 (5)
Heparin	1 (1)	1 (2)	0
Dextrose prolotherapy	1 (1)	1 (2)	0
Arnica	1 (1)	1 (2)	0
Traumeel	1 (1)	1 (2)	0

(*Continued*)

Table 3 (Continued).

	Total (n=72) n (%)	Midportion (n=53) n (%)	Insertion (n=19) n (%)
Non-steroid anti-inflammatory drug	40 (56)	31 (58)	9 (47)
Nitroglycerin patch	4 (6)	4 (8)	0
Biomechanical corrections	28 (39)	20 (38)	8 (42)
Other treatment	5 (7)	3 (6)	2 (11)
Mesotherapy	1 (1)	1 (2)	0
Magnetotherapy	1 (1)	0	1 (5)
Hyperthermia	3 (4)	2 (4)	1 (5)

Notes: [a]Data missing on type of eccentric training for one insertion pain. Multiple response options were allowed for each injury form and six injuries undergoing surgery is not listed.

Statistical Analysis

All analyses were performed using SPSS (IBM SPSS Statistics for Windows, version 27.0. Armonk, NY, USA: IBM Corp). Descriptive data were reported as numbers and percentages with no significance testing between midportion and insertional pain. Neither injury incidence nor injury burden calculations were carried out as this has been done in a separate publication.[6]

Results

A total of 4364 injuries were registered during the five seasons studied with 95 injuries (2.2%) having Achilles tendon injury as the main diagnosis on the general injury form. With seven total Achilles tendon ruptures excluded, this left 88 forms with gradual-onset Achilles tendon pain amongst 72 players. Mean age at injury was 27.5 (SD 4.5) years ranging from 19 to 40 years. Eleven players had two injuries, one player had three injuries, and one player had four injuries; there were 43 right-sided, 40 left-sided, and five bilateral complaints.

In total 14 injuries (16%) were recorded during pre-season in July to mid or late August, and the remaining 74 injuries (84%) during the competitive season from mid or late August to mid or late May (occasionally early June). There were no injuries with zero day time-loss, 16 (18%) with 1–3 days, 26 (30%) with 4–7 days, 29 (33%) with 8–28 days, 16 (18%) with 29–90 days, four (5%) with 91–180 days, one (1%) with >180 days, and one career-ending injury (1%). Lay-off times ranged from one to 563 days.

The specific injury form was returned for 78 of the 88 injury reports with gradual-onset Achilles tendon pain (89%); data were missing for ten injuries amongst nine players from six clubs. As seen in Table 2, midportion pain dominated with 55 cases (71%). The mean age was 27.9 (SD 4.3 and 4.8, respectively) years both for players who reported midportion and insertional pain.

Severe midportion pain (>28 lay-off days) was twice as frequent as severe insertional pain, but with a similar proportion; ten (18%) midportion cases and five (22%) insertional pain cases. Fourteen of the 15 severe injuries (93%) had prodromal symptoms of varying lengths before time-loss.

In total, 49 cases (63%) were examined with ultrasound (US) and 29 cases (37%) with magnetic resonance imaging (MRI), both modalities being used in 18 cases (23%), leaving 18 cases with clinical examination exclusively (23%); three of the clinically diagnosed cases were of moderate severity (9, 10 and 12 days, respectively) and the rest were minimal/minor with 2–6 days. Plain radiographs were added in two cases (one insertional pain in conjunct with US and one midportion pain with both US and MRI).

There was one diagnosis in 57 cases (73%), two diagnoses in 17 cases (22%) and three diagnoses in four cases (5%), respectively. Tendinopathy was the most frequently ticked main diagnosis both for midportion and insertional pain with 60 cases (77%). There were six cases (8%) with both tendinopathy and paratendinopathy, four cases (5%) with both tendinopathy and bursitis, and two cases (3%) with both paratendinopathy and bursitis. All four cases with a third

diagnosis were Haglund deformity for insertional pain (Table 2). All clinically diagnosed cases had one diagnosis (tendinopathy) except for one with a combination of paratendinopathy and bursitis.

As seen in Table 2, in 28 cases (36%) the player had no preceding symptoms at all prior to time-loss from football. Unable to play was the most frequently stated time-loss reason followed by safety precaution with a similar distribution between midportion and insertion pain. Twenty-one cases were index injuries (twelve midportions and nine insertions) and seven cases re-injuries (six midportions and one insertion) with previous symptoms, but with a symptom-free interval.

As seen in Table 3, several different non-surgical treatment modalities were used in various combinations, with eccentric training and cryotherapy being the most frequent ones, used in 52 (72%) cases each, and non-steroid anti-inflammatory drugs in third place with 40 (56%). There was a discrepancy in how deep the dorsiflexion angle during the eccentric training was allowed for midportion and insertional tendon pain with both full dorsiflexion more than 90° and to neutral plantigrade position being used. Shockwave treatment was used more often in insertional pain, whereas injections were used more often in midportion pain, but otherwise there were no relevant differences between localisations. Six injuries (8%) were treated with various surgical approaches, two for midportion and four for insertional pain, and all these players had prodromal symptoms of varying lengths before time-loss.

Discussion

There were three principal findings of the current study on male professional players. First, tendinopathy was the most frequent diagnosis both for midportion and insertional pain. Second, imaging with US and/or MRI was carried out for most injuries. Third, most injuries were managed non-surgically, with eccentric training and cryotherapy being the most frequently applied treatments.

Where is the Pain Most Commonly Located?

Midportion and insertional pain are two completely different entities.[7] Consequently, imaging findings and preferred treatments might differ between them, but no previous study has investigated this specifically in a cohort of professional football players. A novel finding of this study was, therefore, that Achilles tendon-related pain leading to time-loss was more than twice as frequent in the midportion than in the tendon insertion. We have previously reported that players with all-type Achilles tendon injuries were significantly older than players without Achilles tendon-related time-loss.[6] The mean age of players with Achilles tendon injuries was 27.2 years in that study, which is in line with the 27.9 years for both midportion and insertional pain in the current study. The fact that there was no age difference between players with midportion and insertional pain was a bit surprising, because intuitively one might expect relatively more insertional complaints with older age.

How Important is Imaging?

The value of using routine diagnostic imaging has been debated recently.[17] In the current study, more than one-fifth of the injuries were diagnosed via clinical examination only without imaging, most were given the diagnosis tendinopathy and had only a few days on the sidelines. However, based on the fact that at least two diagnoses were reported for more than one-quarter of the injuries in this study and that plantaris-related diagnoses were rare, and possibly overlooked, it seems reasonable to use imaging such as US and/or MRI in at least the less straightforward cases such as when there is pain around, but no palpable thickening of, the Achilles tendon or in insertional pain where multiple tissue involvement is more the rule than exception.

Routine US imaging as part of a pre-season health evaluation or a medical check-up before signing of a player might also be of importance as tendon abnormalities, in particular, tendon thickening, in asymptomatic male professional players have been associated with an increased susceptibility of developing subsequent symptoms within the following year.[18,19] Unfortunately, we have no data on whether such baseline imaging was carried out in our cohort and could have influenced the decision of further imaging when symptoms developed, which is a limitation of our study.

Diagnosis

This study showed that tendinopathy was the most frequently reported main diagnosis both for midportion and insertional pain (77%). Typically, tendinopathy is non-contact by nature and is characterised by gradual symptom onset frequently with prodromal pain before actual time-loss occurs, the latter often linked to reduced performance. The fact that one-quarter of the injuries were severe with a lay-off time of at least four weeks, including one career-ending injury, implies that obtaining an early diagnosis is likely of importance, not the least as all severe injuries except one (93%) and all six surgical cases had prodromal symptoms of varying lengths before the actual time-loss.

Interestingly, there was only one reported injury to the plantaris tendon in the current study, even if this was a separate tick-box option on the Achilles-specific injury form. It has, however, been shown that the plantaris tendon can be involved in both midportion and insertional Achilles tendinopathy, not the least when non-surgical treatment fails.[20,21] Importantly, the plantaris tendon can likely also be the sole contributor to midportion pain with a completely normal Achilles tendon.[22] It is possible that the awareness of plantaris involvement has increased during recent years, but as the study period was 2013–2017 this is a limitation of the current study and needs to be addressed in future studies.

Is Treatment Evidence-Based?

There is a paucity of high-quality prospective studies evaluating risk factors for Achilles tendinopathy in athletes.[23] Studies indicate that active (non-surgical) treatment regardless of type seems to be better in the short term for midportion pain than a wait-and-see approach;[24] no firm conclusions from randomised controlled trials can, however, be drawn on the myriads of treatments available, such as the ones used in the current study, due to significant risk of bias and limited certainty of evidence. Two other recent systematic reviews with meta-analysis have, however, indicated that eccentric training seems to be superior to other types of physiotherapy and exercises in midportion pain.[25,26] Eccentric training was used in two-thirds of the midportion injuries in the current study and was, together with cryotherapy, the most common treatment. There was, however, no uniform approach in terms of allowing high dorsiflexion or not during the tendon loading for either midportion or insertional pain. It seems, however, that full dorsiflexion (>90 degrees) should be used for midportion pain and dorsiflexion to floor level (90 degrees) for insertional pain.[27] The discrepancy found in the current study should, however, be interpreted with caution because the Achilles-specific injury form has not undergone a formal validation procedure, which is a limitation of the current study.

When comparing treatments used for midportion and insertional pain, various injections were used relatively more often in the former and shockwave treatment was used relatively more often in the latter, but there were no clinically relevant differences for the other treatments. Only 10% of the injuries were treated with platelet-rich plasma (PRP) injections, all for midportion pain except one injury, and the low percentage here harmonises with a recent systematic review with meta-analysis of four randomised controlled trials showing no better clinical outcome with PRP than placebo.[28]

Interestingly, more than half of the midportion injuries were treated with non-steroid anti-inflammatory drugs (NSAIDs). A high usage of NSAIDs and other painkillers in professional and international football players is widespread and well known.[29,30] Even if there is a lack of both rationale and scientific evidence for an inflammatory response and using NSAIDs in long-standing Achilles tendon pain,[31] they might still be theoretically beneficial in the very early stages of tendinopathy development.[9] We have, however, no data on exactly the time-point when NSAIDs were used and it is also possible that they were prescribed for an accompanying bursitis, and this is a limitation of the current study.

Methodological Considerations

There are a number of strengths with the current study such as being part of an established injury surveillance project since 2001, having several consecutive seasons included, having an expected high capture rate and diagnostic accuracy, and being carried out on a homogeneous cohort of male professional players. There are, however, also some further limitations other than those already discussed. First, this study only included injuries for which non-contact Achilles tendon-related injuries with gradual onset were recorded as the main diagnosis on the general injury form. Consequently, there might be some under-reporting in so-called multiple-location complaints, but this should have minimal impact on

the findings. Second, only time-loss injuries were recorded which does not show the whole picture in terms of symptom prevalence. Some players can continue to train and play with symptomatic tendinopathies, whereas others are unable to continue playing. This means that recording tendon injuries with a time-loss definition represents only the tip of the iceberg.[32] Third, the imaging procedures and referrals most likely varied between teams and clinicians, and this might have influenced the recording of the location and diagnosis of the injuries. Fourth, we had no access to players directly, and consequently, no data from validated patient-reported outcome measurements could be used for symptom evaluation. Fifth, only a minority of players were treated with surgery, and the low sample size together with the filter of reported details on the specific injury form do not allow us to compare different surgical approaches and outcomes.

Conclusion

In this prospective sub-study of the UEFA ECIS on more than 2000 male professional players in total during five consecutive seasons, tendinopathy was the most frequent main diagnosis amongst male professional football players both for midportion and insertional Achilles tendon pain. Imaging was carried out for most injuries, and most injuries were managed non-surgically, with eccentric training and cryotherapy being the most frequently applied treatments.

Acknowledgments

The authors thank the participating clubs for their participation in the study.

Funding

This study was funded by grants from the UEFA.

Disclosure

Dr Markus Waldén reports personal fees from Arthrex, outside the submitted work. The authors report no conflicts of interest in this work.

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