Treatment Approaches for Plantar Fasciopathy in Elite Athletes

A Scoping Review of the Literature

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Background: Plantar fasciopathy is a common orthopaedic condition that affects athletes and limits their performance.

Purpose: To conduct a scoping review of the literature to summarize the evidence provided so far for the management of plantar fasciopathy in elite athletes and identify potential gaps in the current knowledge.

Study Design: Scoping review; Level of evidence, 5.

Methods: This scoping review followed the 6-stage methodological framework of Arksey and O'Malley and was registered in the Open Science Framework. PubMed, Scopus, and Web of Science were used to identify eligible articles. After charting of data, studies were pooled into 3 categories: epidemiological/diagnostic studies, outcome research focused on plantar fasciitis or partial tears, and studies on the rupture of the plantar fascia. The modified Coleman Methodology Score was used to assess the quality of included articles.

Results: Of 742 initial studies, 10 were selected (109 patients): 8 level 4 articles and 2 level 5 articles. In 4 studies (91 athletes), potential risk factors were discussed but not investigated (ie, preexistent thickening of the fascia, spike shoes, varus hindfoot/knee alignment). In 3 studies (6 athletes) focusing on plantar fasciitis, the nonsurgical treatment led to a satisfactory but poorly documented outcome. In 3 studies (12 athletes), the rupture of the fascia was treated nonoperatively with contrasting results, while surgery was performed only in 2 cases. The mean modified Coleman Methodology Score was 19 (range, 3-42), demonstrating overall poor methodology.

Conclusion: The limited number of studies and their poor quality do not allow to define the gold standard treatment of plantar fasciopathy in elite athletes. Until high-quality studies are provided, clinicians have to rely on the available literature regarding the nonprofessional or nonathletic population to make the best evidence-based decision.

Keywords: athlete; elite; professional; plantar fascia; fasciitis; fasciopathy; rupture

Plantar fasciopathy is a common reason of referral to orthopaedic surgeons. In the general population, its prevalence has been estimated at 7%,[6] with a higher incidence between 40 and 60 years of age. It generally presents with pain of various degrees, ranging from slight and intermittent discomfort to almost invalidating pain under the heel.[5] While in the past a great importance was attributed to the bony spur and the surrounding inflammation,[15,34] often observed in lateral foot radiographs at the plantar aspect of the calcaneus, it has now been demonstrated that pathophysiologically the symptoms are related to the fibrofatty degenerative changes at the proximal insertion of the plantar fascia, especially around its medial band.[34,36] In this scenario, the bony prominence seems to be associated with plantar fascia thickening but not the development of plantar heel pain.[11,20]

The first approach to the disease is agreed upon worldwide and is based on general nonsurgical measures: rest, local icing, anti-inflammatory medications, insoles, exercises to eccentrically strengthen muscles of the posterior chain (in particular, the triceps surae to reduce the amount of mechanical stress transmitted at the plantar fascia), and injections.[12,16,34] In case of failure of such treatment, some authors advocate the surgical release of the fascia or fasciotomy, which generally requires a small incision plantarly and medially at the heel[2,10,14] or a proximal medial

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gastrocnemius release.[10,22] Nevertheless, results after surgery have so far been contradictory, and the value of fasciotomy is still debated.[18,37]

In elite athletes, plantar fasciopathy might significantly affect the level of function, sometimes forcing one to a prolonged period of rest and influencing performance during the season.[27,34] To date, no author has investigated the pathophysiology of plantar fasciopathy in this population; therefore, no data are available to determine if there are differences as compared with nonathletic or semiprofessional patients. Surgery in professional players represents a potentially career-ending event, especially in case of rupture of the fascia, which makes the decision-making process even more complex for these patients.[30]

In this setting, we performed a scoping review of the literature to summarize the evidence provided so far in the management of plantar fasciopathy in elite athletes and to identify potential gaps in current knowledge. We hypothesized that the number and quality of studies published thus far might enable us to define the grade of recommendation for nonoperative or surgical treatments in this cohort of patients.

METHODS

Protocol and Registration

This scoping review was designed according to the PRISMA-ScR checklist (Preferred Reporting Items for Systematic Reviews and Meta-analyses Extension for Scoping Reviews) and followed the 6-stage methodological frameworks of Arksey and O'Malley.[17] The protocol was registered in the Open Science Framework (10.17605/OSF.IO/48S3 K).

Eligibility Criteria

The inclusion criteria for this review were as follows:

- Studies reporting data on acute or chronic plantar fasciopathy (fasciitis and rupture of the fascia) in elite athletes or players aged 15 and 85 years—with *elite athlete* defined as "a person who is currently or has previously competed as a varsity player (individual or team), a professional player or a national or international level player"[32]
- Prospective and retrospective cohort studies, case reports, and technical notes
- English-language articles
- Full-text availability, either online or after direct contact with the authors

Letters to the editor, instructional courses, expert opinions, cadaveric studies, studies on animals, and biomechanical studies were excluded. References from previous narrative or systematic reviews were analyzed and extracted if indicated. In studies reporting data on players of different levels, only results regarding elite athletes were gathered.

Information Sources and Search

A systematic search was conducted on PubMed, Scopus, and Web of Science from the earliest entries through October 22, 2021, with the following Boolean operator: (plantar fasc*) AND (athlete OR player). Two reviewers (M.C. and D.M.) independently screened the results of the research; then, the full texts of eligible studies were analyzed. Disputes were resolved by the senior author (A.B.).

Data Charting and Items

Data were charted independently by 2 investigators (A.S. and C.D.), and results were compared between the investigators to verify that no data had been missed. Data extracted were year of publication, type of study, level of evidence, demographics (sample size, sex, age), treatment investigated, length of follow-up, clinical scores with pre- and postoperative values, radiological outcome assessed through ultrasound or magnetic resonance imaging (MRI), success criteria, failure rate, intra- and postoperative complications in case of surgical treatment, and sport activity resumption time. Failure was considered as absence of relief from symptoms or need for further treatment.

The included studies were pooled into 3 categories: epidemiological/diagnostic studies, outcome research focused on plantar fasciitis or partial tears, and studies on plantar fascia ruptures.

Critical Appraisal of Included Studies

The modified Coleman Methodology Score (mCMS) was used to assess the quality of studies included, as in a previous investigation on foot and ankle pathology.[1] The mCMS ranges from 0 to 100, with 85 considered excellent, 70 to 84 good, 50 to 69 moderate, and <50 considered poor. Two investigators performed the mCMS twice (M.C. and D.M.) with an interval of 10 days, discussing the scores when a >2-point difference was present until consensus was reached.

Synthesis of Results

Summarized data were presented as total numbers, percentages, means, and ranges. All analyses were performed using the Stata statistical software package (version 14.0; StataCorp). A critical analysis was provided for each outcome even if a formal statistical approach was not possible because of the lack of data in primary studies.

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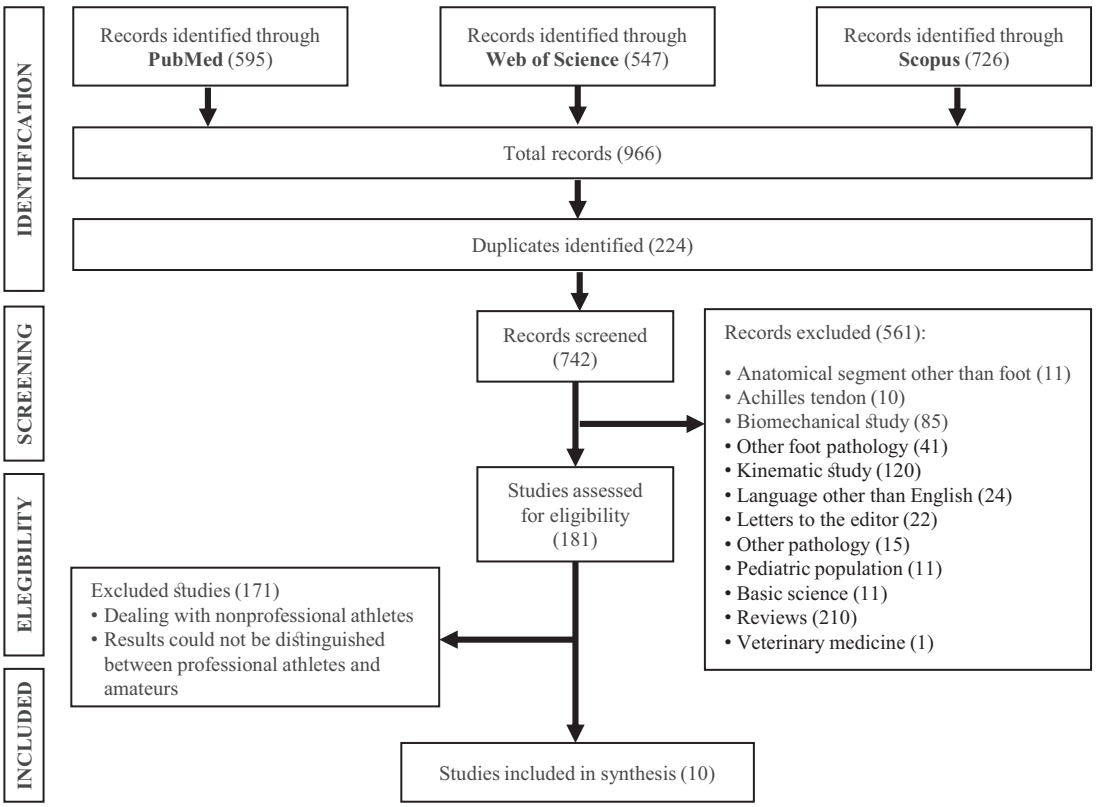

Figure 1. Flowchart of the selection of studies included in this review.

TABLE 1
Main Characteristics of the Included Studies [a]

Lead Author (Year)	Study Design	LOE	Sample Size (M:F)	Mean Age, y
Epidemiological/diagnostic				
di Caprio (2010)[3]	Case series	4	166 (86:80)	31.1
Egwu (2013)[7]	Case-control	3	30 (NR)	NR
Elias (2013)[8]	Case series	4	12 (5:7)	27.8
Walls (2010)[35]	Case series	4	18 (8:10)	26
Outcomes related				
James (2010)[13]	Case series	4	11 (11:0)	NR
Nunn (1997)[25]	Case series	4	4 (0:4)	NR
Pascoe (2016)[26]	Case report	5	1 (1:0)	32
Fascia rupture				
Saxena (2004)[29]	Case series	4	18 (12:6)	40.9
Schaarup (2020)[30]	Case series	4	5 (NR)	NR
Suzue (2014)[33]	Case report	5	1 (1:0)	29

[a] F, female; LOE, level of evidence; M, male; NR, not reported.

RESULTS

Of 742 potentially eligible articles, we identified 181 studies related to plantar fasciopathy in the athletic population. Of these, 10 studies reporting data on 109 elite athletes were included in this review,[‡] as depicted in the flowchart (Figure 1). Table 1 summarizes the characteristics of each study, and Table 2 shows the mCMS per item and study.

[‡]References 3, 7, 8, 13, 25, 26, 29, 30, 33, 35

Epidemiological/Diagnostic Studies

Four studies (61 athletes with plantar fasciitis, 30 asymptomatic athletes) investigated risk factors and diagnostic tools for plantar fasciitis.[3,7,8,35] Among 110 competitive runners, 42 (38.2%) presented with symptoms and signs of plantar fasciitis. In that study, spike shoes were identified as a clear risk factor for plantar fasciitis in the competitive population. Specific anatomic morphotypes also represented risk factors, such as the cavus foot, varus

TABLE 2
Quality of Studies as Assessed with the mCMS [a]

	mCMS Item [b]											
Lead Author (Year)	1	2	3	4	5	6	7	8	9	10	11	Total
Epidemiological/ diagnostic												
di Caprio (2010)[3]	10	10	0	2	5	0	0	0	0	0	5	32
Egwu (2013)[7]	10	0	0	3	5	0	0	0	0	0	0	23
Elias (2013)[8]	0	0	0	2	5	10	0	0	0	0	2	24
Walls (2010)[35]	0	0	0	2	0	0	0	0	0	3	2	7
Outcomes related												
James (2010)[13]	0	0	10	2	0	3	0	0	2	3	5	25
Nunn (1997)[25]	0	0	10	0	0	0	0	0	0	0	0	14
Pascoe (2016)[26]	0	0	10	0	0	3	0	0	0	0	0	13
Fascia rupture												
Saxena (2004)[29]	0	10	10	3	0	3	2	0	2	0	5	35
Schaarup (2020)[30]	0	10	10	0	0	10	5	0	3	2	2	42
Suzue (2014)[33]	0	0	5	0	0	10	0	5	2	0	0	22

[a] mCMS, modified Coleman Methodological Score.
[b] Item description (scoring out of 100): 1 = number of patients (0-10), 2 = mean follow-up (0-10), 3 = number of different procedures in each outcome (0-10), 4 = type of study (0-15), 5 = description of diagnosis (0-5), 6 = description of technique (0-10), 7 = description of postoperative rehabilitation (0-5), 8 = complications discussed (0-10), 9 = outcome criteria (0-10), 10 = procedure of assessing outcomes (0-10), 11 = description of subject selection process (0-10).

hindfoot, and varus knee.[3] In a cohort of 18 Irish dancers, MRI findings of fasciitis were documented in 7 cases but demonstrated a poor correlation with symptoms.[35] Egwu et al[7] showed that the thickness of the plantar fascia in athletes was increased as compared with nonathletes (mean, 3.7 vs 3.2 mm). Finally, at the 2012 London Olympic games, 12 of 10,568 athletes imaged with MRI showed signs of acute plantar fascia injury.[8] The mean mCMS of the epidemiological/diagnostic studies in this subgroup was 19 (range, 7-32), indicating poor quality (Table 2).

Outcome Research on Plantar Fasciitis/Partial Tears

Three studies (6 patients) documented the results of different treatments in plantar fasciitis[13,25,26] (Table 3). There were 2 studies with level 4 evidence and 1 study with level 5.

In a case series[25] of 4 elite kendo practitioners with symptoms of fasciitis, the authors underlined the role of the well-known RICE protocol (rest, ice, compression, elevation) in the short term and the value of considering appropriate floors (ie, sprung wooden rather than wood on concrete) and footwears to achieve good long-term results. One report discussed the advantage of injecting local anaesthetic pregame and corticosteroids postgame in a football player with symptoms of plantar fasciitis,[13] with immediate return to sport. The third study utilized a poorly specified physical therapy in a soccer player diagnosed with a partial-thickness tear of the proximal plantar fascia,[26] which allowed return to sport at 16 weeks from the injury. The mean mCMS for the studies in this subgroup was 8 (range, 3-12) (Table 2).

Studies on Rupture of the Plantar Fascia

We found 3 studies[29,30,33] (12 patients) dealing with rupture of the plantar fascia in elite athletes: 2 case series (level 4 evidence)[29,30] and 1 case report (level 5 evidence)[33] (Table 4).

The results of nonsurgical treatment in the 2 case series were inconsistent. While Saxena et al[29] reported a return to activity at a mean 5 weeks in 6 elite athletes after a 3- to 6-week period of complete unloading of the foot, followed by protected weightbearing in a boot, Schaarup et al[30] documented no ability to return to sport in a gymnast and a sprinter treated with an unloading boot for 6 weeks, foot orthoses, and physical therapy. On the other side, a return to the same level of performance within 12 months was documented in 2 gymnasts after surgical repair using 2 suture anchors.[30] Finally, in the case report by Suzue et al,[33] a soccer player treated with platelet-rich plasma injection returned to his level of training at 5 months. The mean mCMS of the studies in this subgroup was 31 (range, 17-42) (Table 3).

DISCUSSION

The most important finding of this analysis is that the number and quality of studies investigating the management of plantar fasciopathy (as fasciitis and rupture) in elite athletes is clearly insufficient to support the clinician in daily decision making. In the 10 studies available in this area,[‡] only 18 elite athletes (out of 109 overall) were part of a therapeutic investigation, with the largest cohort being represented by Saxena et al[29] (just 6 elite athletes). In addition, the mCMS was never >50, indicating that all studies had poor methodological quality.

In the interpretation of the results of this review, a few key points have to be considered. First, during the research of eligible articles, we found a nonnegligible number (n = 181) related to plantar fasciitis in the athlete, thus witnessing the great interest around this condition in sport. However, in many cases, authors did not distinguish ab initio between professional and nonprofessional athletes, and in many other studies, results were presented mixing the 2 categories.[9,21,23,28] Because of this, the meticulous application of exclusion criteria led to their removal, although this induced us to think that a relevant amount of data might remain hidden because of nonoptimal study designs. Second, in the analysis of treatments for plantar fasciitis, we were not surprised to verify that nonsurgical treatment was the most frequent choice among authors,[13,25,26] but we expected to find a greater number of studies documenting the results of different treatment strategies. However, one should consider that elite athletes represent a small proportion of the athletic population, which makes it difficult to report results in samples

TABLE 3
Studies Reporting the Clinical Outcome After Treatment of Plantar Fasciopathy [a]

Author	Treatment	Mean Follow-up	Imaging	Failure Rate	Complication Rate	Return to Sport	Level of Sport
James (2010)[13,b]	Ropivacaine injection at the calcaneal attachment of the plantar fascia (pregame) and with corticosteroids (postgame)	NR	NR	0/1	0/1	1 h after injection	Preinjury
Nunn (1997)[25]	RICE protocol, "adjustment" maneuver of metatarsal heads (chiropractor)	NR	NR	NR	0/4	NR	NR
Pascoe (2016)[26]	Immobilization and crutches for pain-free ambulation; progression to pain-free weightbearing exercises, strengthening, flexibility, and sport-specific exercises as tolerated	3.5 mo	MRI	0/1	0/1	3.5 mo	Preinjury

[a] No studies reported clinical scores. Success criterion per study: return to activity. NR, not reported; RICE, rest, ice, compression, elevation.
[b] This case report included only 1 patient with plantar fasciopathy.

TABLE 4
Studies Reporting the Clinical Outcome After Treatment of Plantar Fascia Rupture [a]

Author	Treatment	Mean Follow-up	Faliure Rate	Complication Rate	Return to Sport, mo
Saxena (2004)[29]	Nonoperative	42 mo	0/18	0/18	42
Schaarup (2020)[30]		8 y			3
Surgical	2		0/2	0/2	
Nonoperative	3		3/3	0/3	
Suzue (2014)[33]	Nonoperative	9 mo	0/1	1 fascia rupture	9

[a] No studies reported clinical scores. All studies utilized magnetic resonance imaging. Success criterion per study: return to activity. Level of sport per study: preinjury. NR, not reported.

appropriately sized and homogeneous. Also, professional team physicians have to concentrate their efforts to speed the recovery of players, since this obviously represents the main interest of the team, without necessarily being incentivized to share their results in conferences or through scientific publications. Third, in professional sport, the need of immediate high-level performance might dictate some choices that would be unlikely in the rest of population, as documented by James et al,[13] where a football player received a local anaesthetic injection just before a game to be able to withstand his symptoms from plantar fasciitis. Last, orthopaedic injuries might have a negative impact on the careers of players[31]; therefore, such injuries tend to be downplayed,[4] which could generate further bias in the estimation of the actual incidence of these injuries.

Given our findings, we recommend treating elite athletes with plantar fasciopathy nonsurgically, using stretching exercises, taping, footwear modifications, and orthoses, per the most recent guidelines.[19,24] To date, the role of surgery through plantar fasciotomy or gastrocnemius recession remains unclear and supported by only a few studies.[34]

Limitations

We acknowledge some limitations of this study. The limited number of studies, their low methodological quality, and the small sample sizes involved have to be taken in mind. Also, we have to mention the inability to perform any formal statistical analysis, which in turn was due to the absence of clinical scores in primary studies. A third limitation was the methodological heterogeneity of the included studies, which weakened our findings. Nevertheless, we think that pooling studies into 3 subgroups might help to provide a more structured view on the topic, which, to the best of our knowledge, has been lacking in literature until now.

CONCLUSION

The limited number of studies and their poor quality do not allow us to draw any clear conclusion on the best treatment of plantar fasciopathy in elite athletes. Until high-quality studies are provided, clinicians have no choice but to rely on the available literature regarding the nonprofessional or nonathletic population to make the most evidence-based decision possible. We advocate future comparative studies to shed some light on the superiority of one treatment as compared with another in this specific patient population.

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