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Hindfoot pain

Terminology, treatment and outcome

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General discussion

TERMINOLOGY

Several Achilles tendon related disorders can be distinguished and for each pathology different definitions and terms or eponyms arose over time. As a result, the terminology for Achilles tendon related disorders is inconsistent and confusing. Maffulli et al. advocate using the term tendinopathy to describe clinical overuse conditions around the tendon, which is a combination of pain, swelling and impaired performance. Depending on the affected tissue, the terms tendinopathy, paratendinopathy or pantendinopathy were proposed. [1] In 2011, terminology for Achilles tendon related disorders was proposed based on anatomic location, symptoms, clinical findings and histopathology to effectuate uniform and clear terminology. [2] The following five terms were proposed: mid-portion Achilles tendinopathy, insertional Achilles tendinopathy, Achilles paratendinopathy, retrocalcaneal bursitis and superficial calcaneal bursitis. Also, it was proposed to depart from eponyms because using eponymous terms is an inaccurate and unreliable method of communication. [3-5] Uniform terminology provides the ability to communicate with a universal language in daily practice amongst clinicians and researchers. **Chapter 2** evaluates the current terminology used and assesses the influence of the latest proposals on the terminology used for Achilles tendon related disorders in both daily practice and literature. It consisted of two parts: a survey among orthopedic surgeons and a literature search. The study showed that terminology for Achilles tendon related disorders according to the latest proposals based on anatomic location, symptoms, clinical findings and histopathology is being used by the majority of orthopedic surgeons in daily practice and is increasingly being used in literature. However, eponyms are still frequently used in Achilles tendon related terminology. A possible reason for this is the ingrained use of the eponym Haglund. Eponymous terms are often used in clinical settings and are passed onto the residents and students. [3, 6] Is this because medical professionals are proud of their predecessors? Maybe this eponymous nomenclature has become lasting? [6] Or is it negligence because of the wide variation of terms? Chapter 2 creates awareness of used terminology. However, it is insufficient to pursue just uniformity in the use of terminology. There should be a guideline for diagnoses of Achilles tendon related disorders where the correct terminology is used. This guideline should be based on scientific literature and formed by specialists in the field, preferably worldwide. Also, authors of original research articles should at least be familiar with the clinical definitions and clearly define the condition to create clear terminology. In addition, errors or uncertainties of nomenclature need to be corrected in the peer review process before publication.

MID-PORCION ACHILLES TENDINOPATHY

Mid-portion Achilles tendinopathy is frequently seen in the Dutch primary care setting with an incidence rate of 2.35 per 1.000 per year in the adult population. [7] Mid-portion Achilles tendinopathy is a clinical diagnosis characterized by pain and swelling located at 2-7 cm from the

insertion onto the calcaneus, often combined with impaired performance. [2] The actual cause of pain is still unknown. If patients are unresponsive to conservative treatment, surgical treatment is indicated. [8] In 2016 a comprehensive systematic review on outcomes of surgical treatment for mid-portion Achilles tendinopathy was performed. [9] Twenty-three studies were grouped into five types of procedures: open surgery, minimally invasive tendon stripping/tenotomies, endoscopic procedures, open surgery for gastrocnemius lengthening, open surgery for resection of the distal Achilles tendon, followed by interposition of the flexor hallucis longus (FHL) tendon. Limited understanding of the exact pathophysiology has largely contributed to the large variation in techniques for the first three groups: release of the Achilles tendon, debridement of degenerative tissue, longitudinal tenotomies, a combination of debridement of degenerative tissue and longitudinal tenotomies, excision of degenerations followed by side-to-side sutures, release of the Achilles tendon and excision of the plantaris tendon, longitudinal tenotomies with additional release of adhesions by infiltration, debridement of the paratenon with additional release of the plantaris tendon or additional longitudinal tenotomies. It was concluded that minimally invasive and endoscopic procedures yield lower complication rates with similar patient satisfaction in comparison with open procedures. Nevertheless, no conclusion was drawn about the preferred surgical technique.

It is hypothesized that intratendinous degeneration and nodular thickening of the Achilles tendon without appropriate healing are the cause of pain. Performing multiple tenotomies would relieve symptoms by increasing the blood supply and thus the presence of viable cells that can improve the healing process of the Achilles tendon. [10, 11] The thought that degeneration of the tendon is the main cause of the pain is questionable. [12] Literature suggests that the intratendinous structure changes and thus restoration of the Achilles tendon is not required for improvement of symptoms and that intratendinous changes can exist without symptoms. [13, 14]

Another theory is that the causes of pain are the neovascularizations and accompanying ingrowth of nerve fibers in combination with the adhesions from the plantaris tendon to the Achilles tendon. [12] Normally, the plantaris tendon can move freely in relation to the Achilles tendon, however in case of mid-portion Achilles tendinopathy, the inflammatory response of the paratenon causes adhesions between those two structures wherefore release can help to alleviate symptoms. [4, 15-17] It is important to recognize mid- to long-term results of the various techniques that have shown good short-term outcome. Long-term results are important when the degenerative lesion is left untouched. **Chapter 3** shows a high mid- to long-term patient satisfaction and good functional outcomes in terms of patient reported outcome measures (Foot and Ankle Outcome Score (FAOS) and Victorian Institute of Sport assessment for the Achilles tendon (VISA-A) in patients affected by mid-portion Achilles tendinopathy who were endoscopically treated by means of release of the paratenon in combination with transection of the plantaris tendon. [18] This supports the theory that the intratendinous degenerative lesions can be left untouched. It is therefore advocated to not perform tenotomies, as it is reported that the calf circumference and ankle plantarflexion strength are not fully restored after multiple tenotomies. [10] Also, in patients with mid-portion Achilles tendinopathy, the plantaris tendon is morphologically affected in a comparable way as the Achilles

tendon. There is sensory innervation of the connective tissue in the plantaris tendon tissue proper that can explain that plantaris resection helps to alleviate symptoms. [15, 16] Therefore, resection of the plantaris tendon should be the standard in treatment for mid-portion Achilles tendinopathy.

RETROCALCANEAL BURSTITIS

Retrocalcaneal bursitis is an inflammation of the bursa between the superoposterior aspect of the calcaneus and ventral side of the Achilles tendon caused by repetitive compression resulting in painful swelling, medial and lateral to the Achilles tendon at the level of the posterosuperior calcaneal prominence. [2] If patients are unresponsive to conservative treatment, surgical treatment can offer a solution. Open procedures consist of osteotomies or excision of excessive bone of the calcaneal prominence with a variation of approaches. Nowadays endoscopic treatment is considered to be superior to open interventions for retrocalcaneal bursitis. [19] The inflamed retrocalcaneal bursa and the bony prominence of the calcaneus on the impingement site are removed under visualization. Patients are more satisfied, the rehabilitation period is shorter, resumption of daily activities is quicker, the cosmetic results are better and there is a lower complication rate compared to an open procedure. In a systematic review on the outcomes of surgical treatment of chronic retrocalcaneal bursitis, the one major complication in 150 endoscopic procedures was an Achilles tendon rupture three weeks after the operation. [20] There is better visualization during endoscopic calcaneoplasty. A smaller resection volume is seen in endoscopic versus open bone resection which reduces the risk of weakening the insertion. [21] A biomechanical study compared postsurgical pullout strength following endoscopic calcaneoplasty and midline tendon-splitting approach in cadaveric specimens. The postsurgical pullout strength following endoscopic calcaneoplasty was significantly higher than that for midline tendon-splitting calcaneoplasty, approximately three times, whereby it appears that the endoscopic technique preserves the native Achilles tendon strength. [22] Short-term outcome of endoscopic calcaneoplasty already showed good results. [23, 24] In **chapter 4** mid- to long-term results of endoscopic calcaneoplasty were reported, showing a high patient satisfaction and good long-term functional outcome in terms of the FAOS and the American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Scale in patients affected by retrocalcaneal bursitis who underwent endoscopic calcaneoplasty. With these good results on the long-term, endoscopic calcaneoplasty should be preferred over open surgery.

FLEXOR HALLUCIS LONGUS (STENOSING) TENOSYNOVITIS

Flexor hallucis longus (FHL) (stenosing) tenosynovitis is relatively unknown in the general population but more common among athletes who perform repetitive forefoot push-offs. [25] The majority of patients with FHL tenosynovitis experience retromalleolar pain due to constriction of the

FHL at the level of the fibro-osseous tunnel. The purpose of **Chapter 5** was to evaluate the literature on treatment of FHL (stenosing) tenosynovitis and to provide an overview of the different treatment options as well as an analysis, evaluation and comparison of their outcomes. There are many conservative treatment options reported for FHL (stenosing) tenosynovitis, but only of stretching and lidocaine injections the outcomes are reported. A lidocaine injection into the proximal sheath along the FHL tendon to inflate the tendon sheath is sufficient in one out of three patients. Stretching of the FHL had a successful outcome in 64% of the patients. [26, 27]

Five open techniques were described and one endoscopic technique for release of the FHL tendon. [28, 29] Two studies reported a success rate of operative treatment and both were 100%. All athletes returned to sport after 5 weeks. Ninety percent of the athletes have a full return to sport after a mean time of 4 months. However, of the included studies, the study designs were heterogeneous and the methodologic quality was low whereby the level of evidence of this study is limited. There is a lack of evidence in the literature. Most of the included studies had a small number of included patients. Also, none of the included studies was comparative. Nevertheless, this study gives a review of the available literature and shows that there is a need for high-quality prospective studies which use inclusion criteria that are clearly and outcome measurements that are validated.

As stated in the previous paragraph, injection therapy for FHL (stenosing) tenosynovitis had good results in 33% of the cases. [27] Ultrasound guided injections in the flexor hallucis longus tendon sheath resulted in 100% success rate in two studies with 25 cases. If tenography was used an adequate injection placement of 87% was reported. [30-32] These studies reported on image-guided injections, however, performance of blind injection based on clinical examination and thus without image-guided techniques have not been evaluated. The argument for imaging guidance is increased accuracy and thus maximization of clinical benefits of this injection. Literature showed that for subacromial impingement syndrome in the shoulder, ultrasound-guided injections provide no additional clinical benefit over unguided injections. [33, 34] Ultrasound guided injections provide a real-time image with visualization of the needle and adjacent structures, but only in experienced hands of a radiologist since there is a learning curve to handle the instrument and interpreting the images. Image guiding comes with additional costs. **Chapter 6** showed that the FHL tendon sheath could be injected without ultrasound guidance and placement only based on clinical examination with a 100% success rate. This blinded technique is useful since it is time and cost effective and imaging devices are not required. Routine use of image guiding is therefore not necessary.

POSTERIOR ANKLE IMPINGEMENT SYNDROME

Posterior ankle impingement syndrome (PAIS) is a pain syndrome that is experienced at the posterior aspect of the ankle on forced plantarflexion. PAIS is most common in sports and athletic activities involving repetitive hyperplantarflexion such as soccer and ballet dancing. Open and endoscopic surgical procedures for PAIS yield good outcome. Endoscopic treatment seems superior

to open procedures in terms of complication rates and time to return to full activity. [35] Even though we know that posterior ankle arthroscopy is safe and effective for treatment of PAIS, first conservative treatment should be considered.

In daily practice corticosteroid injections are often used for PAIS, however reports on the effect on pain are lacking. [36-38] Robinson and Bollen evaluated the efficacy of steroid and anesthetic injections in ten elite soccer players suffering from PAIS. [38] All returned to previous level of sport within three weeks after injection. An os trigonum was found in two subjects, of which one was symptom free after a second injection and the other after endoscopic resection of the os trigonum and synovitis after one failed injection. Messiou et al. showed that eight out of nine athletes were asymptomatic after injection at a follow-up of 18 months. [37] And Kudas et al. described 26 cases of PAIS in elite football players of which conservative treatment was effective in 2/3 of the cases. [39] When an athlete experiences PAIS, it is important that he is free of complaints as soon as possible and that he is not delayed in performing with time consuming conservative or surgical treatment. It is important to know what can be expected of a treatment, especially when the professional career is relatively short. [40] In **chapter 7** it was hypothesized that corticosteroid injections are regularly used and have a positive effect on pain reduction in ballet dancers with PAIS. It is concluded that there is a high prevalence of PAIS in ballet dancers of 38% and corticosteroid injections are regularly used for pain reduction with good results. This retrospective survey with a small number of patients is a start for future research. There is a lack of literature on the difference in outcome of conservative treatment of the different types of impingement, such as pain, time to return to sport or recurrence rate. A prospective study is required to inform the ballet dancers with hard facts about the outcome of corticosteroid injection therapy on pain and return to dance in different types of PAIS.

PATIENT-REPORTED OUTCOME MEASURES

A valid, reliable and responsive patient-reported outcome measure (PROM) can measure “the value” from a patient’s perspective and provide better information for value-based healthcare. [41, 42] Worldwide there are up to 50 PROMs in the field of foot and ankle diseases. [43] In the Dutch language, the Foot and Ankle Outcome Score (FAOS) and the Foot and Ankle Ability Measurement (FAAM) are validated as foot- and ankle-PROMs. The Manchester Foot Pain and Disability Index (MFPDI) and the 5-point Foot Function Index (FFI-5pt) are validated as foot-PROMs. There are two disorder-specific PROMs, namely, the Victorian Institute of Sports Assessment-Achilles (VISA-A) for Achilles tendinopathies and the Foot Impact Scale for Rheumatoid Arthritis (FIS-RA). [44]

In 2007, a PROM specific for Achilles tendon ruptures was developed: the Achilles tendon Total Rupture Score (ATRS). [45] In **chapter 8** the ATRS was translated to Dutch and its reliability and validity in the Dutch population was evaluated. The ATRS has an adequate reliability and validity. It can be used in the Dutch population for measuring the outcome of treatment of an Achilles

tendon rupture and for research purposes. However, the minimal detectable change (MDC) at the individual level was low. Our study did not assess the responsiveness or the minimum clinically important differences. Recently, Dams et al. investigated the responsiveness of the Dutch ATRS and concluded that the Dutch ATRS is responsive to change in the clinical follow-up period (3 and 6 months) after Achilles tendon rupture. [46] The Dutch ATRS can be used for longitudinal research and has the ability to detect changes over time, as reflected by its responsiveness, which is useful for clinical use. [47] Also, in addition to the disorder-specific PROMs, there are the generic PROMs that relate to the patient's general health and quality of life, like for example the SF-36 and the EQ-5D. [48, 49] All these PROMs can help refine surgical indications or improve shared-decision making. The downside however are the expenses. Furthermore, filling out the forms is time consuming and a burden to the patient.

The National Institutes of Health (NIH) invested in Patient-Reported Outcomes Measurement Information System (PROMIS®) to overcome these limitations. PROMIS® was developed using item databases and computerized adapted testing (CAT). [50] An item database is a set of questions that measure the same construct. The items are placed in order of difficulty using the item response theory. The CAT selects the next question. This question is easier or more difficult, based on the patients' response to the previous question. The Dutch–Flemish PROMIS Group was established in 2009, to implement PROMIS® in the Netherlands and Flanders. PROMIS® results in more relevant questions, shorter questionnaires and a reliable score, however, it consists of generic PROMs only and major strides are still required to cover all constructs. [51, 52]

CONCLUSIONS

1. The revised terminology for Achilles tendon related disorders based on anatomic location, symptoms, clinical findings and histopathology is used by the majority of orthopedic surgeons and is increasingly used in literature. However, the indistinct Haglund eponyms are still frequently used in Achilles tendon related terminology.
2. There is a high patient satisfaction and good functional outcomes in patients affected by mid-portion Achilles tendinopathy who were endoscopically treated by means of release of the paratenon in combination with transection of the plantaris tendon on the mid- to long-term.
3. Patients affected by retrocalcaneal bursitis who underwent endoscopic calcaneoplasty show high patient satisfaction and good long-term functional outcome.
4. Based on current best available evidence, there are many conservative treatment options mentioned for FHL tenosynovitis. Nevertheless, only outcomes of stretching and lidocaine injections are reported. If conservative treatment does not give sufficient relief of symptoms, operative treatment, by releasing the FHL by an arthroscopic or open technique, offers a safe and effective solution. Thereby, arthroscopic techniques are promising. However there is a paucity of literature on this issue.

5. The FHL tendon sheath can be blindly injected based on only clinical examination with high accuracy. This is useful information since imaging guidance is not needed. This saves time, saves costs and is easier logistically.
6. In ballet dancers there is a high prevalence of posterior ankle impingement syndrome (PAIS). Corticosteroid injections are used regularly with good results for pain reduction.
7. The Dutch Achilles tendon Total Rupture Score (ATRS) shows an adequate reliability and validity, and can be used in the Dutch population for measuring the outcome of treatment of an Achilles tendon rupture and for research purposes.

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