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### Achilles tendinopathy: new insights in cause of pain, diagnosis and management

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# Chapter 1

## Terminology for Achilles tendon related disorders Time for a change

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## ABSTRACT

The terminology of Achilles tendon pathology has become inconsistent and confusing throughout the years. For proper research, assessment and treatment, a uniform and clear terminology is necessary. A new terminology is proposed; the definitions hereof encompass the anatomic location, symptoms, clinical findings and histopathology.

It comprises the following definitions: *Midportion Achilles tendinopathy*: a clinical syndrome characterized by a combination of pain, swelling and impaired performance. It includes, but is not limited to, the histopathological diagnosis of tendinosis. *Achilles paratendinopathy*: an *acute* or *chronic* inflammation and/or degeneration of the thin membrane around the Achilles tendon. There are clear distinctions between acute paratendinopathy and chronic paratendinopathy, both in symptoms as in histopathology. *Insertional Achilles tendinopathy*: located at the insertion of the Achilles tendon onto the calcaneus, bone spurs and calcifications in the tendon proper at the insertion site may exist. *Retrocalcaneal bursitis*: an inflammation of the bursa in the recess between the anterior inferior side of the Achilles tendon and the posterosuperior aspect of the calcaneus (retrocalcaneal recess). *Superficial calcaneal bursitis*: inflammation of the bursa located between a calcaneal prominence or the Achilles tendon and the skin.

Finally, it is suggested that previous terms as Haglund's disease; Haglund's syndrome; Haglund's deformity; pump bump (calcaneus altus; high prow heels; knobbly heels; cucumber heel), are no longer used.

## INTRODUCTION

Overuse injuries of the Achilles tendon can be either insertional or non-insertional. As there is no evidence available for chronic inflammation in patients with “tendinitis”, the term tendinosis has been proposed instead<sup>1</sup>. In 1998, Maffulli et al. proposed to use the term “tendinopathy” for the clinical syndrome characterized by a combination of pain, swelling and impaired performance<sup>23</sup>. In Haglund’s syndrome, the pain is located at the postero-superior calcaneal prominence. Originally, Haglund described pain in the hindfoot caused by a prominent postero-superior corner of the calcaneus in combination with wearing a rigid low-back shoe<sup>2,10</sup>. Today, when using the term Haglund’s exostosis, physicians are usually referring to a clinical situation of pain and tenderness at the postero-lateral aspect of the calcaneus, where a calcaneal prominence can often be palpated. This is also known as “pump-bump”, with alternative names as calcaneus altus, high prow heels, knobby heels, and cucumber heel.

A distinction between Haglund’s disease and other conditions such as a superficial Achilles bursitis must be made. Haglund’s disease must be differentiated from Haglund’s syndrome, which involves a painful swelling of an inflamed retrocalcaneal bursa, sometimes combined with insertional tendinopathy of the Achilles tendon. It must also be distinguished from Haglund’s disease, which is the term of osteochondrosis of the accessory navicular bone. No doubt that all this is confusing: in reality, many different names and terms are used in the literature. The purpose of this paper is to propose a terminology which includes the combination of anatomic location, symptoms, clinical findings and pathological changes for each entity.

## HISTORICAL PERSPECTIVE

### Midportion Achilles tendinopathy

Philip Verheyen, a Dutch surgeon, was the first in 1693 to actually name the Achilles tendon after the Greek hero Achilles<sup>16</sup>. Previously, it was known as “tendo magnus of Hippocrates”. In 1883, Raynal described the first case of “cellulite peritendineuse of the Achilles tendon”<sup>32</sup>. Other cases of “cellulite peritendineuse” of the Achilles tendon followed shortly<sup>2,17</sup>.

In 1905, Schanz was the first to describe a traumatic inflammation of the Achilles tendon: He described a patient who experienced ‘a chronic strain’ after mountain climbing<sup>36</sup>. He entitled this “tendinitis Achillea traumatica”<sup>36</sup>. The inflammation was presumed to be located in the Achilles tendon itself, instead of the insertion into the calcaneus, contrary to the standard or ideas of the time<sup>1,34</sup>.

The terminology has changed more or less constantly, often without any evident scientific reason throughout the 20<sup>th</sup> century. In 1950, Lipscomb proposed new definitions for inflammatory processes of tendons. He defined "*paratendinitis*" as an inflammatory process of tendons or portions of tendons without a tendon sheath; "*tenosynovitis*" was implemented to refer to inflammatory processes of tendons with a sheath. Additionally, he proposed "*peritendinitis*" as a general term to refer to either "*tenosynovitis*" or "*paratendinitis*"<sup>20</sup>.

Since the 1970's, increased effort was put in categorising Achilles tendon pathology, related to subgroups. In 1976, Perugia et al. introduced new terminology on inflammatory problems of the Achilles tendon<sup>30</sup>. They based their definitions on histological findings. Perugia et al. differentiated between pure peritendinitis, peritendinitis associated with tendinosis, and pure tendinosis. Peritendinitis was characterised by the presence of inflammation of the peritendinous sheaths, without any pathological changes in the tendon itself. Peritendinitis associated with tendinosis involved degenerative features of the tendon associated with inflammation of the sheaths. Pure tendinosis was said to be characterized by degenerative phenomena exclusively, often associated with foci of osteo-cartilaginous metaplasia. Later in the same year, Puddu et al. published a paper clarifying the new terms introduced by Perugia et al<sup>30,31</sup>. Tendinosis implied tendon degeneration, without any clinical or histological signs of intratendinous inflammation.

Throughout the years, the discussion continued on the terminology of the location and on the actual nomenclature of Achilles tendon disorders<sup>9,39</sup>. It took, however, until 1992 for Clain and Baxter to divide the definitions of Achilles "*tendinitis*" in insertional and non-insertional<sup>6</sup>.

In 1998, Maffulli et al.<sup>23</sup> suggested to change the confusing terminology concerning overuse tendon conditions. They proposed to use the terms "*tendinosis*"<sup>15</sup>, "*paratendinitis*", and "*tendinitis*" only *after* excision biopsy had been examined by a pathologist as these imply specific, histopathologically proven conditions, with inflammatory cells<sup>23</sup>. They advised not to use the aforementioned terms in clinical practice when discussing overuse tendon injuries. The term "*partial tear*" should be reserved to acute partial tendinous lesions. In fact, this term may be questioned altogether whether it does exist or not. "*Achillodynia*" is a purely descriptive term, referring to pain in the region of the Achilles tendon<sup>1,24,34</sup>. Finally, Maffulli et al. proposed to name the clinical syndrome of pain, swelling (diffuse or localised), and impaired performance as tendinopathy. Depending on the involved tissues, the terms tendinopathy, paratendinopathy, and pantendinopathy should be used<sup>23</sup>. Maffulli et al's publication has greatly helped to reduce the confusion in clinical terminology; the proposal was broadly accepted, but it was not, however, implemented universally. Terminology has therefore remained confusing<sup>27,40</sup>.

## Pathology around the Achilles tendon insertion

Albert<sup>1</sup> was the first to describe 'Achillodynia' in 1893, but the underlying pathology was not determined, however<sup>25</sup>. In 1895, Rössler<sup>34</sup> found that the cause of this Achillodynia was an inflammation of the bursa between the insertion of the Achilles tendon and the postero-superior tuberosity of the calcaneus. Three years later, Painter published his histological findings after resection of the post-calcaneal exostosis causing the inflammation of the post-calcaneal bursa<sup>28</sup>. He concluded the exostoses were most probably manifestations of an osteoarthritic process. In Patrick Haglund's opinion, the term Achillodynia was too general, and he divided patients into three groups: 'Achillotendinitis ossificans', 'Bursitis Achillea', and children with growth problems of the epiphysis of the calcaneus. In terms of "bursitis Achillea", he noted there were 2 bursae: one located between the calcaneus and the skin (bursa Achillea infero-posterior), and one between the Achilles tendon and the calcaneus (bursa Achillea supero-anterior). In his opinion, the superficial bursitis was caused by incorrect shoe-wear for 'Kulturmenschen' (culture people), and the other (deep bursitis) by either acute or chronic trauma. The inferior posterior bursitis had, in his opinion, no clinical relevance, but the superior anterior bursitis, caused by impingement between the Achilles tendon and a bony *prominence*, on the calcaneus caused clinically relevant signs and symptoms. This condition can be treated surgically by resecting the postero-superior bony prominence of the calcaneus in case conservative measures fail<sup>10,28</sup>. In 1954, the term 'pump bump' arose. Dickinson et al. described the 'pump bump' as an enlargement of the posterolateral aspect of the heel at the site of the insertion of the Achilles tendon and Achilles tendon bursitis, mostly associated with wearing high heel shoes. When conservative treatment failed, patients were treated surgically by excision of the posterosuperior corner of the calcaneus<sup>7</sup>.

Until 1982, inflammation of the retro-calcaneal bursa caused by impingement between the anterior aspect of the Achilles tendon and the posterior part of the calcaneus was named retrocalcaneal bursitis. In that year, Pavlov et al. first described the 'Haglund's syndrome', defined as a frequent cause of posterior heel pain, characterized by a painful soft tissue swelling at the level of the Achilles tendon insertion. Using a lateral heel radiograph, they described a prominent calcaneal bursal projection, retro-calcaneal bursitis, thickening of the Achilles tendon, and a convexity of the superficial soft tissues at the level of the Achilles tendon insertion, a 'pump bump'<sup>29</sup>. This is the first publication in which the authors used the name 'Haglund'. Haglund's deformity was then described by Vega et al. as a tender swelling in the region of the Achilles tendon with visible prominence of the postero-lateral aspect of the calcaneus. In their opinion, the superficial Achilles bursa and/or the retrocalcaneal bursa reflected the enlarged prominence. Then, in 1990 and 1991 'analogies' for Haglund's deformity were described: Haglund's syndrome, achillobursitis, achillodynia, and retro-calcaneal bursitis were mentioned<sup>18,33</sup>. In 1993, Haglund's *disease* was added to this list<sup>3</sup>, although

it was earlier described as being an osteochondrosis of the accessory navicular bone (or os tibiale externum)<sup>5,18,42</sup>.

Sella et al.<sup>38</sup> thought that all these names were confusing, and proposed separate definitions for Haglund's disease, Haglund's syndrome, and Haglund's deformity. Haglund's disease was referred to as osteochondrosis of the accessory navicular; Haglund's deformity as a chronic, sometimes painful distortion of the postero-superior and lateral portion of the calcaneus; and the term Haglund's syndrome was used when symptoms were present with/without the deformity, and may involve the retro-calcaneal bursa as well as the Achilles tendon and the superficial Achilles bursa<sup>38</sup>. This proposal was, however, not commonly adapted, and many publications kept using terms interchangeably<sup>4,11-13,19,21,22,26,37</sup>.

In 1998, the Federative Committee on Anatomical Terminology and the International Federation of Associations of Anatomists published a general anatomic terminology<sup>8</sup>. This "Terminologia Anatomica" defines the retrocalcaneal bursa as "bursa tendinis calcanei" and the superficial calcaneal bursa is termed the "bursa subcutanea calcanea"<sup>8</sup>.

## **PROPOSED TERMINOLOGY FOR ACHILLES TENDON RELATED DISORDERS**

Examining the evolution of the terminology over the years, the efforts and the struggle are obvious. Some terms represent a disease, some an anatomic location, a pathology, or a generic name. The reasoning behind a change in terminology is unclear; it appears largely to be susceptible to fashion. In the 19<sup>th</sup> century, the terminology was mainly based on anatomy<sup>1</sup>; later, it was based on histopathology<sup>30</sup>; others have proposed a 'history'-based terminology<sup>3,29,38</sup>.

Five leading anatomy journals were contacted, and asked for information on which terminology they demanded from their authors. Based on the answers, it can be concluded that, concerning anatomy, there is no such thing as a "standard terminology". Some stated that the authors were expected to use "widely accepted terminology".

The *definitions* for Achilles tendon disorders should comprise anatomic location, symptoms, clinical findings, and histopathology. The *term* to represent the entity must be neutral yet descriptive, uniform and clear. The aforementioned lack of consistency should be avoided as much as possible. The following definitions are therefore proposed (Table 1).

**Table 1.** Terminology for Achilles tendon related disorders, including the anatomic location, symptoms, clinical findings histopathology. For radiographic findings, see table 2

<b>Term</b>	<b>Anatomic location</b>	<b>Symptoms</b>	<b>Clinical findings</b>	<b>Histopathology</b>
<b>Midportion Achilles tendinopathy</b>	2-7 cm from the insertion onto the calcaneus	A combination of pain, swelling and impaired performance	Diffuse or localized swelling	includes, but is not limited to, the histopathological diagnosis of tendinosis: implies histopathological diagnosis of tendon degeneration without clinical or histological signs of intratendinous inflammation, not necessarily symptomatic
<b>Paratendinopathy</b>				
<b>Acute</b>	around the mid-portion Achilles tendon	Edema and hyperemia	palpable crepitations, swelling	edema and hyperemia of paratenon, with infiltration of inflammatory cells, possibly with production of a fibrinous exudate that fills the space between tendon sheath and tendon.
<b>Chronic</b>	around the mid-portion Achilles tendon	Exercise-induced pain	crepitations and swelling less pronounced	paratenon thickened as a result of fibrinous exudate, prominent and widespread proliferation of (myo)fibroblasts, formation of new connective tissue and adhesions between tendon, paratenon, and crural fascia
<b>Insertional Achilles tendinopathy</b>	insertion of Achilles tendon onto calcaneus, most often with formation of bone spurs and calcifications in tendon proper at insertion site	Pain, stiffness, sometimes a (solid) swelling	Painful tendon insertion at the <i>mid-portion</i> of the <i>posterior</i> aspect of the calcaneus, swelling may be visible and a bony spur may be palpable	ossification of enthesial fibrocartilage, and sometimes small tendon tears occurring at tendon-bone junction
<b>Retrocalcaneal bursitis</b>	Bursa in the recess between the anterior inferior side of the Achilles tendon and the <i>posterosuperior</i> aspect of the calcaneus (retrocalcaneal recess)	Painful swelling superior to calcaneus	painful soft tissue swelling, medial and lateral to the Achilles tendon at the level of the posterosuperior calcaneus	Fibro-cartilaginous bursal walls show degeneration and/or calcification, with hypertrophy of the synovial infoldings and accumulation of fluid in the bursa. Alternatively, the bursa may be primarily involved by inflammatory or infectious bursitis due to an inflammatory arthropathy
<b>Superficial calcaneal bursitis</b>	bursa located between calcaneal prominence or the Achilles tendon and the skin	visible, painful, solid swelling posterolateral calcaneus (often associated with shoes with rigid posterior portion)	Visible, painful, solid swelling and discoloration of skin. Most often located at posterolateral calcaneus; sometimes posterior or posteromedial	an acquired adventitious bursa, developing in response to friction. When inflamed, lined by hypertrophic synovial tissue and fluid.



Table 2. Radiologic findings in Achilles tendon disorders

Term/imaging	Plain Radiography	Ultrasound	CT	MRI
<b>Midportion Achilles tendinopathy</b>	Deviation of soft tissue contours is usually present. In rare cases calcifications can be found	Tendon larger than normal in both cross-sectional area and antero-posterior diameter. Hypoechoic areas within the tendon, disruption of fibrillar pattern, increase in tendon vascularity (Echo-Doppler) mainly in ventral peritendinous area	In case (massive) calcification are seen on plain radiography. CT imaging can be helpful in pre-operative planning, showing the exact size and location of the calcifications	Fat-saturated T1 or T2 images: fusiform expansion, central enhancement consistent with intratendinous neovascularization
<b>Paratendinopathy</b> <b>Acute</b>	-	A normal Achilles tendon with circumferential hypoechoic halo	-	Peripheral enhancement on fat-saturated T1 or on T2 images
<b>Chronic</b>		A thickened hypoechoic paratenon with poorly defined borders may show as a sign of peritendinous adhesions; increase in tendon vascularity (Echo-Doppler) mainly in ventral peritendinous area		
<b>Insertional Achilles tendinopathy</b>	May show ossification or a bone spur at the tendon's insertion; possibly deviation of soft tissue contours	Calcaneal bony abnormalities	Bone formation at insertion. CT scan is indicated mainly for pre-operative planning. It shows the exact location and size of the calcifications and spurs	Bone formation and/or on STIR (short tau inversion recovery) hyperintense signal at tendon insertion
<b>Retrocalcaneal bursitis</b>	A posterosuperior calcaneal prominence can be identified; radio-opacity of the retrocalcaneal recess; possibly deviation of soft tissue contours	Fluid in the retrocalcaneal area/bursa (hyperechoic)	-	Hyperintense signal in retrocalcaneal recess on T2 weighed images
<b>Superficial calcaneal bursitis</b>	Possibly deviation of soft tissue contours	Fluid between skin and Achilles tendon	-	Hyperintense signal between Achilles tendon and subcutaneous tissue on T2 weighed images

### Midportion Achilles tendinopathy

Achilles tendinopathy is a clinical syndrome characterized by a combination of pain, swelling and impaired performance. The swelling can be diffuse or localized. Typically, the nodular swelling is located at 2-7 cm from the insertion onto the calcaneus. This part of the tendon has also been described as the “main body of the Achilles tendon”. This entity involves isolated pathology of the tendon proper, and includes, but is not limited to, the histopathological diagnosis of tendinosis<sup>23</sup>.

Tendinosis implies histopathological diagnosis of tendon degeneration without clinical or histological signs of intratendinous inflammation, and is not necessarily symptomatic<sup>14</sup>. However, it should be kept in mind that, although the histological term ‘tendinosis’ is also widely used, the essential lesion of tendinopathy is not, *strictu sensu*, of a degenerative nature: it has the features of a failed healing response, in which the tendon attempts to heal, but, for some reason, including, possibly, continuous inappropriate mechanical stimuli, the healing process appears non-finalised.

### Achilles paratendinopathy

Paratendinopathy is defined by acute or chronic inflammation and/or degeneration of the thin membrane around the Achilles tendon. Exercise-induced pain and local swelling around the tendon’s midportion are the most important symptoms.

Histopathologically, *acute* paratendinopathy is characterized by edema and hyperemia of the paratenon, with infiltration of inflammatory cells, possibly with production of a fibrinous exudate that fills the space between the tendon sheath and the tendon, causing palpable crepitations on physical examination. In *chronic* Achilles paratendinopathy, exercise-induced pain is the major symptom, while crepitations and swelling are less pronounced. Histopathologically, the paratenon becomes thickened as a result of fibrinous exudate, prominent and widespread proliferation of (myo)fibroblasts, formation of new connective tissue and adhesions between tendon, paratenon, and the crural fascia<sup>27</sup>.

### Insertional Achilles tendinopathy

Insertional Achilles tendinopathy is located at the insertion of the Achilles tendon onto the calcaneus, possibly with the formation of bone spurs and calcifications in the tendon proper at the insertion site. Patients complain of pain and stiffness and sometimes (a solid) swelling. On physical examination, the tendon insertion (at the midportion of the posterior aspect of the calcaneus) is painful. A swelling may be visible and a bony spur may be palpable. Histopathologically, there is ossification of enthesial fibrocartilage, and sometimes small tendon tears occurring at the tendon-bone junction<sup>35</sup>.

### **Retrocalcaneal bursitis**

An inflammation of the bursa in the recess between the anterior inferior side of the Achilles tendon and the posterosuperior aspect of the calcaneus (retrocalcaneal recess) results in a visible and painful soft tissue swelling, medial and lateral to the Achilles tendon at the level of the posterosuperior calcaneus. Frequently, a posterosuperior calcaneal prominence can be identified at plain radiography. Histopathologically, the fibro-cartilaginous bursal walls show degeneration and/or calcification, with hypertrophy of the synovial infoldings and accumulation of fluid in the bursa itself<sup>41</sup>. Alternatively, the bursa may be primarily involved by inflammatory or infectious bursitis due to an inflammatory arthropathy.

### **Superficial calcaneal bursitis**

An inflammation of the bursa located between a calcaneal prominence or the Achilles tendon and the skin resulting in a visible, painful, solid swelling and discoloration of the skin. It is most often located at the posterolateral aspect of the calcaneus. It is frequently associated with shoes with a rigid posterior portion. The Achilles tendon is usually not involved, however. Histopathologically, the subcutaneous bursa is an adventitious bursa, which is acquired after birth, and develops in response to friction. It is lined by hypertrophic synovial tissue and fluid. A superficial calcaneal bursitis can be further specified by its location, i.e. posterior, posterolateral, or posteromedial.

Achilles tendinopathy and paratendinopathy often co-exist. Retro-calcaneal bursitis is often seen in combination with insertional tendinopathy. Other combinations are possible, but occur less frequently.

## **CONCLUSION**

An inconsistent and erroneous change in nomenclature of disorders of the Achilles tendon throughout the years has resulted in a large pool of confusing definitions and terms. A uniform and clear terminology is necessary for proper research, diagnostics and treatment. Proposed are new definitions, based on the anatomic location, symptoms, clinical findings and histopathology. In addition it is proposed that Haglund's disease, Haglund's syndrome, Haglund's deformity, pump bump (calcaneus altus; high prow heels; knobby heels; cucumber heel), tendinitis are no longer used.

One of the following, depending on pathology, should be used instead: *Midportion Achilles tendinopathy*; *Achilles paratendinopathy*; *insertional Achilles tendinopathy*; *retrocalcaneal bursitis* and *superficial calcaneal bursitis*.

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