Achilles Tendon, Injury and Treatment

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OBJECTIVES

1. No one falls asleep
2. Review to physiology
3. Apply to clinical
Function

Connect muscle to bone

Transmission of force from muscle to bone

> movement of the joint

Resist movement
Structure Overview

Tendon

Brilliant white

Morphology

Collagen Content

- Type I - constitutes about 60% of the tendon and 95% of the total collagen
- Type III and V – make up the other 5%

Cellular

- 90-95% tenoblasts/tenocytes
- 5-10% chondrocytes/synovial cells/vascular cells

Fibro-elastic

Tropocollagen helix

Morphology
Blood Supply

Intrinsic
- Myo-tendinous junction
- Osteotendinous junction

Extrinsic
- Paratenon
- Synovial
Innervation

Golgi tendon organ links the muscle and the tendon.

Golgi tendon organ consists of sensory nerve endings interwoven among collagen fibers.

- Extrafusal muscle fibers
- Afferent neuron
- Capsule
- Collagen fiber
- Tendon
- Sensory neuron
Biomechanics

Stress-strain curve showing basic physical properties of a tendon

Stress (force/area)

Strain %

Toe

Failure
Response to exercise/immobility

![Diagram showing the response to exercise/immobility. The diagram illustrates the cycle between tissue quality and loading state, with arrows indicating transitions from immobilization to exercise and back, highlighting the dynamic relationship between these factors.](image-url)
Affect of Age
Types of Injury

- **Tendinitis**
  - Inflammation of the tendon

- **Tendinosis**
  - Chronic disease state of tendon without inflammation

- **Tenosynovitis**
  - Tenosynovitis is inflammation of the tendon sheath.

- **Paratenonitis**
  - Inflammation of the paratenon
Healing Process

1. Acute inflammatory phase
2. Proliferative phase
3. Maturation and remodeling phase
Achilles Tendon
Critical Zone

2–6 cm proximal to the calcaneal insertion, the tendons blood supply is diminished. This region of decreased vascularity is the usual region of Achilles rupture.

Epidemiology - Achilles Tendinopathy

- Epidemiology
  - Associated with running/jumping
  - 6-18% all sporting injuries
  - Average age 30-55 years
  - Male predominance 6:1 ratio
  - 30% are bi-lateral
  - 41% of patients will go on to develop contra-lateral symptoms

To summarize; overuse injury to the Achilles tendon occurs at all ages, but more frequently in middle-aged (30-55 years old) individuals, and is related to running and jumping with a high risk of bilateral injury.
Terminology

Classification of Achilles tendon injury

- Acute injuries:
  - Acute total rupture
  - Partial rupture

- Overuse injuries:
  - Acute phase:
    - Distal bursitis
    - Midportion paratendonitis
  - Chronic phase:
    - Distal Achilles tendinopathy
    - Midportion Achilles tendinopathy
<table>
<thead>
<tr>
<th>Pathological diagnosis</th>
<th>Concept (macroscopic pathology)</th>
<th>Histological appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tendinosis</td>
<td>Intratendinous degeneration (commonly caused by ageing, microtrauma and vascular compromise)</td>
<td>Collagen disorientation, disorganisation and fiber separation with an increase in cells and vascular space with or without neovascularisation and focal necrosis or calcification</td>
</tr>
<tr>
<td>Tendinitis/ partial rupture</td>
<td>Symptomatic degeneration of the tendon with vascular disruption and inflammatory repair response</td>
<td>Degenerative changes as noted above with superimposed evidence of tear, including fibroblastic and myofibroblastic proliferation, haemorrhage and organising granulation tissue</td>
</tr>
<tr>
<td>Tendinitis/ partial rupture</td>
<td>Inflammation of the outer layer of the tendon (paratenon) alone, regardless of whether the paratenon is lined by synovium</td>
<td>Mucoid degeneration in the areolar tissue is seen. A scattered mild mononuclear infiltrate with or without focal fibrin deposition and fibrinous exudate is also seen</td>
</tr>
<tr>
<td>Paratenonitis with tendinosis</td>
<td>Paratenonitis associated with intratendinous degeneration</td>
<td>Degenerative changes as noted for tendinosis with mucoid degeneration with or without fibrosis and scattered inflammatory cells in the paratenon alveolar tissue</td>
</tr>
</tbody>
</table>
Achilles Tendinosis

- No evidence of inflammation
- Tendon loses normal appearance
- Microscopic evaluation: cell disorganisation, degeneration, scarring
ACHILLES TENDINOSIS

Stage 1
- No pain with exercise
- Post exercise stiffness
- Local tenderness

Stage 2
- Pain during exercise
- No limitation to activity
- Stiffness post exercise >
- Local tenderness

Stage 3
- Pain with exercise
- < performance
- Prolonged pain / stiffness
- > tenderness

Stage 4
- Cannot exercise
- Prolonged stiffness
- ++ tenderness
Aetiology - Achilles Tendinopathy

**Intrinsic factors**
- Age
- Biomechanical
- Decreased flexibility
- Gender
- Leg length discrepancy
- Muscle weakness / imbalance
- Tendon blood supply

**Extrinsic factors**
- Environmental condition
- Excessive loading
- Footwear
- Training errors
- Side-effects of drug treatment

**Pathology**
Pathogenesis – Achilles Tendinopathy

The overuse type of tendon injury
DIFFERENTIAL DIAGNOSIS

- Soleus muscle
- Comp syndrom
- Tumours
- Os~T
- Plantar fasciitis
- PTTDS
- AT Rupture
- FHL / FDL
- Peroneal
- TTS
- Referred pain
- Stress #
DIAGNOSIS + MANAGEMENT

THEM
Physical Evaluation Observation

Risk Prevention Footwear Compliance
STAGE 1 - TREATMENT

- Partial Rest
- Avoid risk factors
- Flexibility
- Eccentric strengthening
- Physical therapy
Treatment - Chronic

• In 90 of the 101 Achilles tendons (89%) with chronic painful mid-portion Achilles tendinosis, treatment was satisfactory and the patients were back on their pre-injury activity level after the 12-week training regimen
Interventions for treating acute and chronic Achilles tendinitis

McLachlan GJ, Handoll HHG

Summary

Not enough evidence about the best way to relieve a painful Achilles tendon

The Achilles tendon is at the back of the ankle. A swollen and painful Achilles tendon can result from a change in the type and intensity of activity. When severe, it is very painful to walk. Rest, restricted activity, drugs to relieve swelling and pain as well as wearing inserts in footwear are common treatments. Other remedies, including surgery, are used when the pain and swelling continue. The review of trials did not find enough evidence to show which methods of treating painful Achilles tendons are effective.

Search strategy

The Cochrane Musculoskeletal Injuries Group specialised register (December 2000), Cochrane Controlled Trials Register (The Cochrane Library issue 4, 2000), MEDLINE (1966 to December 2000), EMBASE (1980 to 2001 wk 04), CINAHL (1982 to December 2000), and reference lists of identified trials were searched.

Selection criteria

Randomised or quasi-randomised trials of treatment interventions for acute and chronic Achilles tendinitis in adults. Studies focusing on pathological tendinitis were excluded. Excluded were those trials that compared different dosages of the same drug or drugs within the same class of drugs, for example different non-steroidal anti-inflammatory drugs (NSAIDs).

Data collection and analysis

Three reviewers independently assessed trial quality, by use of a ten item check list, and extracted data. Requests were sent for separate data for Achilles tendinitis patients in studies within trials of mixed patient populations. Where possible, quantitative analysis and limited pooling of data were undertaken.

Main results

Nine trials, involving 697 patients, met the inclusion criteria of the review. Methodological quality was adequate in most of the trials with regards to blinding but the assessment of outcome was incomplete and short-term.

There was weak but not robust evidence from three trials of a modest benefit of NSAIDs for the alleviation of acute symptoms. There was some weak evidence of no difference compared with no treatment of low dose heparin, heel pads, topical laser therapy and pentidiodon steroid injection, but this could not be fully evaluated from the reports of four trials. The results of an experimental preparation of a self-derived depoerinated haemodialysate, Actovegin, were promising but the severity of patient symptoms was questionable in the single small trial testing this comparison. The results of a comparison of glycosaminoglycan sulfate with a NSAID were inconclusive.

Authors’ conclusions

There is insufficient evidence from randomised controlled trials to determine which method of treatment is the most appropriate for the treatment of acute or chronic Achilles tendinitis. Further research is warranted.
Suspected tendinopathy, ankle radiographs normal. Next study.

<table>
<thead>
<tr>
<th>Radiologic Exam Procedure</th>
<th>Appropriateness Rating</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRI, ankle</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>US, ankle</td>
<td>6</td>
<td>Only if experienced examiner available</td>
</tr>
<tr>
<td>X-ray, ankle, stress films - with manual stressing</td>
<td>2</td>
<td></td>
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<tr>
<td>X-ray, ankle, stress films, - stress using biomechanical device</td>
<td>2</td>
<td></td>
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<tr>
<td>X-ray, ankle, stress films, - manual stress while under general anesthesia</td>
<td>2</td>
<td></td>
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<tr>
<td>NUC, bone scan</td>
<td>2</td>
<td></td>
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<tr>
<td>Conventional arthrography, ankle</td>
<td>2</td>
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<tr>
<td>CT arthrography, ankle</td>
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<tr>
<td>MR arthrography, ankle</td>
<td>2</td>
<td></td>
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<tr>
<td>Tenography, ankle</td>
<td>2</td>
<td></td>
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<tr>
<td>Diagnostic injection of anesthetic, ankle</td>
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</table>
Krebs Cycle/Pentose phosphate shunt/Glycolysis

Krebs cycle

Pentose phosphate shunt

Glycolysis
Achilles Tendon – Physical Examination

Medical History
- Diagnostic imaging
- Trauma

History of Present Illness
- When
- Where
- How

Social History
- Sport?

Medications
- NSAID’s
- Steroids
- ?

Examination
- Pes planus / pes cavus
- Calcaneal alignment varum or valgum
- Hallux valgum / rigidis
- Leg length discrepancy / pelvic rotation
- Strength testing
- ROM testing

Pain
- VAS Scale
- When
- Type
Fig 3

Non-vascular connective tissue

Amount of sugars

Exposure

Glycation

protein accumulation thickening of BM

trapping of LDL in artery wall, thickening

trapping of IgG, complement activation, inflammation

Exposure

Vascular Connective tissue
COLLAGEN DYSFUNCTION

Lysine residues

Hydroxylysine

Lysyl Oxidase
Increased stiffness of the Achilles

- Elasticity
- Density
- Stiffness
- Cross-linking