Introduction

The Achilles tendon is the conjoined tendon of the two heads of the gastrocnemius muscle and the soleus muscle. It is capable to sustain high loads (3 to 10 times of the body weight) and the most often injured tendon. The most common area of tendon rupture is approximately 4-7cm proximal to its insertion; this is also the least vascularized area (Chen et al 2009).

Detailed information about the anatomy of the Achilles tendon can be found on youtube presented by Anatomy&Physiotherapy  https://www.youtube.com/watch?v=4xjYGg-ygoo and  https://www.youtube.com/watch?v=upAh7G9qtm0

Ruptures are divided into “acute ruptures” (diagnosed within four weeks of injury) and “chronic (delayed) ruptures” (diagnosed more than four weeks from injury) due to misdiagnosis (25%) or negligence of the patient. Missed diagnosis occurs more commonly in patients aged 55 or older.
Demographics of Achilles tendon rupture (Maffulli 1999)

Achilles tendon rupture is most common in ages 30-50.
Male : female ratio= 2:1 to 12:1. The prevalence depends on different authors.

Clinical presentation

Frequently patients report a sudden snap with acute pain in the lower calf during an indirect trauma (sometimes direct trauma) with sports participation. This occurs particularly in patients younger than 55 years. The patient describes the feeling as if he or she has been shot, kicked, or cut in the back of the leg and is often not able to ambulate. The immediate pain may soon resolve. In some cases the patient can walk with a limp but is unable to run, climb stairs or stand on the toes. In patients aged 55 or older the event is often not related to sports activity. Therefore misdiagnosis is more common in this age group (Raikin et al 2013).

Three categories of indirect injury:

1) Pushing off with a weight bearing forefoot while also extending the knee
2) Sudden and unexpected dorsiflexion of the ankle (eg slipping of a ladder or chair, stumbling into a hole, suddenly falling forward)
3) Sudden dorsiflexion of a plantar-flexed foot when one falls from a height.
The **aetiology** of Achilles tendon rupture is regarded as **multifactorial**. It can also be **associated with systemic diseases** such as gout, lupus erythematosus and rheumatoid arthritis.

**Main predisposing factors (Hess 2010):**
- Overuse (sports activities: soccer, volleyball, tennis, basketball, squash ...)
- Tendon degeneration (degenerative changes have been shown in specimens obtained from rupture sides)
- Corticosteroids (local injected into rabbit tendons cause necrosis and delayed healing. However, the causality has not yet been proven)
- Fluoroquinolone antibiotics (Quinolone, eg Ciprofloxacin) especially in elderly patients taking oral corticosteroids (van der Linden 2003)
- Diabetes mellitus
- High BMI
- Smoking
- Age

After the subjective examination the following findings during the **physical examination** will confirm the hypotheses of an Achilles tendon rupture.

**Inspection:** swelling around the ankle/Achilles tendon (Fig 3).

In chronic Achilles tendon ruptures calf atrophy may be present.

![Ruptured and normal Achilles tendon](http://singaporeosteopathy.com/2015/06/02/common-injuries-of-the-achilles-tendon/)
Active movements (may not be indicated in a very recent injury):
Gait: patient shows a limb, plantarflexion is nearly if not totally impossible (push of phase is impaired, stride length reduced).
Standing on the toes on the affected side: is impossible.
Be aware active plantarflexion in sitting may be possible because the other surrounding muscles and tendons are still intact (especially in chronic Achilles tendon ruptures)
Muscle strength test: decreased plantarflexion strength
Passive ankle tests (Special Tests should be performed before. If passive dorsiflexion is performed this should be done with care): Dorsiflexion will be increased with late and reduced resistance.

Special Tests which should be performed when suspecting Achilles tendon rupture:

1. Matles Test
Patient position: lying prone active (or passive) knee flexion to 90°
Test: the position of the ankle and foot is observed during flexion of the knee.
Positive Test: if the foot falls into neutral or into dorsiflexion

2. Calf Squeeze Test or Thompson Test (Thompson 1962) or Simmonds-Thomson Test (Simmonds 1957) a highly reliable test (Maffulli 1998).
Be aware: in chronic Achilles tendon rupture or partial rupture Thompson test may show a weak plantarflexion response and can therefore be false negative (Thompson and Doherty 1962).
Patient position: lying prone or kneeling with the feet over the end of the table
Test: the examiner squeezes the gastrocnemius-soleus complex (just distal to the area of maximal calf girth) with his hand. Watch the video on IMTA’s facebook.
Positive Test: if the Achilles tendon is ruptured, there will not be any apparent plantar flexion (or only minimal plantar flexion) compared to the unaffected side
Cuttica et al 2015 demonstrated the validity of Thompson Test for diagnosing complete Achilles tendon ruptures
3. Palpation

Test: the examiner gently palpates the course of the tendon

Test interpretation: The gap is classified as present or absent. A gap is indicative for a ruptured Achilles tendon

Be aware in chronic Achilles tendon ruptures

The tendon sheath often becomes thickened and adherent to the retracted ends of the tendon and there is minimal repair tissue in the gap (Leslie and Edwards 2005).

Therefore in a chronic ruptured Achilles tendon a bulbous segment instead of a gap is more likely to be felt. This bulbous segment represents disorganized, irregular scar tissue. As the calf muscle contracts the fibrous scar tissue stretches and heals in an elongated position. As a result there is weakness due to the loss of mechanical efficiency of the triceps surae complex (Padanilam 2009).

Maffulli (1998) studied the sensitivity and specificity of the clinical tests used to diagnose a tear of the Achilles tendon.

His results are presented in the following table:

<table>
<thead>
<tr>
<th>Test (N= numbers of patients) and patient state</th>
<th>Sensitivity</th>
<th>Positive predictive value</th>
<th>Specificity</th>
<th>Negative predictive value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matles (N=77)</td>
<td>0.88</td>
<td>0.92</td>
<td>N = 28</td>
<td>0.92</td>
</tr>
<tr>
<td>Awake</td>
<td>0.94</td>
<td>0.97</td>
<td>0.85</td>
<td></td>
</tr>
<tr>
<td>Anesthesia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calf Squeeze Test (N=133)</td>
<td>0.96</td>
<td>0.98</td>
<td>N = 28</td>
<td>1</td>
</tr>
<tr>
<td>Awake</td>
<td>0.96</td>
<td>0.85</td>
<td>0.93</td>
<td></td>
</tr>
<tr>
<td>Anesthesia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Palpation (N=133)</td>
<td>0.73</td>
<td>0.82</td>
<td>N = 28</td>
<td>1</td>
</tr>
<tr>
<td>Awake</td>
<td>0.81</td>
<td>0.85</td>
<td>0.89</td>
<td></td>
</tr>
<tr>
<td>Anesthesia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A minimum of 2 tests should be positive for the clinical diagnosis of a total Achilles tendon rupture (Maffulli 1998)
Clinical diagnosis is more sensitive than MRI

In a retrospective study Garras et al (2012) compared in 66 patients with surgically confirmed acute Achilles tendon ruptures the sensitivity of physical examination with perioperative MRI. They were able to show that physical examination findings (Thompson test, Maltes Test and a palpable defect) were more sensitive than MRI. The mean duration of diagnosis in the physical examination group was 2.5 days and for surgical intervention 5.6 days after injury. In contrast the mean duration of diagnosis in the MRI group was 5.1 days and for surgical intervention 12.4 days. MRI and or Ultrasound may be helpful in confirming the clinical diagnosis especially in cases with inconsistent findings (Garras et al 2012).

Conclusion

Early diagnosis and treatment (non-surgical or surgical) of Achilles tendon rupture are essential for better prognosis and functional restoration. Clinicians should rely on history and physical examination. Delay in treatment especially in chronic Achilles tendon ruptures may have detrimental effects on the final outcomes (loss of plantar flexion strength, weakness, limb, fatigue, inability to run, heel rise, play sports, climb stairs) (Den Hartog 2008, Rajasekar et al 2005).

If you have any comments or questions please leave a comment on imta facebook or send me an e-mail: gerti.bucher-dollenz@imta.ch

Literature (some can be accessed for free, please use the attached link)


Gerti Bucher-Dollenz 12/2015
Den Hartog BD. Surgical strategies: delayed diagnosis or neglected Achilles' tendon ruptures. Foot Ankle Int. 2008 Apr; 29(4):456-63


Simmonds FA. The diagnosis of the ruptured Achilles tendon. Practitioner. 1957; 179:56–8
