Evidence Based Management of Acute Achilles Tendon Ruptures

Kenneth G. Swan, Jr., MD
Disclosures

• None
Clinical Question

• What is the optimal treatment for a recreational athlete with an acute Achilles tendon rupture?
Achilles---Legendary Greek hero of Trojan war

- Defeated Hector
- Central character in Homer’s *The Iliad*
- Said to be invulnerable due to coat of armor
- As an infant his mother, Thetis, tried to make Achilles immortal by dipping him in the river Styx, holding him by the heel
- Achilles eventually mortally wounded by an arrow to the heel
“Achilles Heel”

• ....a weakness in spite of overall strength, which can actually or potentially lead to downfall.....

• Wikipedia, 2016
What’s in a name?

• Achilles Tendon
• “Tendo Achilles”
• “Heel cord”
• “Tendocalcaneus”

• Os calcis

• Triceps surae
Achilles Tendon Rupture

- Relatively common injury in adult male athletes
- Recreational athletes, “weekend warriors”
- 4th and 5th decade
- Males ~10:1

- Typically a non-contact injury
- “Pop” and pain and cannot RTP
- Often can walk off the court/field
Achilles Rupture

- Usually 2-6cm from heel cord insertion
- Blood flow watershed area?
- Pre-existing tendon degeneration?
- Injury can also occur proximally (MT jxn or muscle belly) or distally (at calcaneus).....
Achilles Rupture: Diagnosis

- **History**
  - Age, mechanism, RTP?
  - **Timeframe**

- **Exam**
  - Swelling, Ecchymosis, Tendon gap
  - Motor fxn may be +/- normal!
  - Abnormal Thompson test

- **Imaging**
  - Xray to r/o boney avulsion, calcific tendonitis
  - MRI: not necessary, but good tool if diagnosis or location of tear in doubt
Thompson Test
Achilles Rupture: Treatment Options

• Non-operative
  – Cast vs. Boot
  – NWB vs Early weight bearing
  – Immobilization vs Early functional rehab

• Operative
  – Open repair
    • Post operative casting vs. boot
    • Post operative NWB vs. Early weight bearing
    • Post operative immobilization vs Early functional rehab
  – Percutaneous repair
Achilles Rupture Treatment

• Considerations:
  – Healing rate
  – Re-rupture
  – Return to function
    • ADLs, Work
    • Sport
  – Timeframe
  – Complications
Achilles Rupture Treatment

- Considerations:
  - Healing rate
  - Re-rupture
  - Return to function
    - ADLs, Work
    - Sport
  - Timeframe
  - Complications

Figure 3. Photograph of the patient’s heel, two weeks postop showing superficial sepsis
Achilles Rupture Treatment

- Considerations:
  - Healing rate
  - Re-rupture
  - Return to function
    - ADLs, Work
    - Sport
  - Timeframe
  - Complications

Figure 3. Photograph of the patient’s heel, two weeks postop showing superficial sepsis.
Operative vs Non-operative

- **Historically:**
  - Non-operative treatment = short-leg cast, NWB for 4-12 weeks
    - **Risk:** Re-rupture (8%-21%)
  - Operative treatment = open repair, then short leg cast, NWB for 4-8 weeks
    - Re-rupture rate 2%-5%
    - **Risk:** Infection/wound complications (0%-5%

Cetti AJSM 1993, Moller JBJS 2001
Operative vs Non-operative: EBM

• What does the evidence tell us regarding operative vs non-operative treatment of Achilles tendon ruptures?

• PUBMED SEARCH OF RELEVANT LEVEL 1-3 STUDIES
# Levels of Evidence

<table>
<thead>
<tr>
<th>Level of Evidence</th>
<th>Grading Criteria</th>
<th>Grade of Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Systematic review of RCTs including meta-analysis</td>
<td>A</td>
</tr>
<tr>
<td>1b</td>
<td>Individual RCT with narrow confidence interval</td>
<td>A</td>
</tr>
<tr>
<td>1c</td>
<td>All and none studies</td>
<td>B</td>
</tr>
<tr>
<td>2a</td>
<td>Systematic review of cohort studies</td>
<td>B</td>
</tr>
<tr>
<td>2b</td>
<td>Individual cohort study and low quality RCT</td>
<td>B</td>
</tr>
<tr>
<td>2c</td>
<td>Outcome research study</td>
<td>C</td>
</tr>
<tr>
<td>3a</td>
<td>Systematic review of case-control studies</td>
<td>C</td>
</tr>
<tr>
<td>3b</td>
<td>Individual case-control study</td>
<td>C</td>
</tr>
<tr>
<td>4</td>
<td>Case-series, poor quality cohort and case-control studies</td>
<td>C</td>
</tr>
<tr>
<td>5</td>
<td>Expert opinion</td>
<td>D</td>
</tr>
</tbody>
</table>

*Source: Ann Surg © 2004 Lippincott Williams & Wilkins*
Operative vs Non-operative

- Meta-analysis, 6 studies, ~450 patients, [Level I/II]
- Level I/II
- **Operative**
  - ~6-8wks cast
  - Re-rupture 3.1%
  - Infection 4.7%
- **Non Operative**
  - ~8wks cast
  - Re-rupture 13%
- For every 10 patients tx’d with surgery, 1 re-rupture prevented
- --1 Infection for every 21 patients who received surgery
- “Surgery generally recommended”
- ***WB status not well defined***
Op vs Non-Op

- Moller, *JBJS (Br)*, 2001
- Level 2 Prospective study

**Non-op**
- 8 wks cast, 4wks NWB
- 21% re-rupture (11pts, 10 just while walking!)
- ~50% abnormal function at 2 years

**Op**
- 2 wks plaster, then **WBAT in boot, functional rehab**
- 1.7% re-rupture
- Better functional outcome, earlier return to work

**Recommendations:** Surgery for Achilles Rupture to prevent re-rupture
Early Motion after Achilles Injury

- Twaddle, *AJSM*, 2007
- RCT, Level 1
- Operative and Non-operative patients treated with early ROM after 2 wks in equinus plaster
  - Active DF to neutral, Passive (gravity) PF
- NWB for 6 wks, both groups
- **42 pts total**, 1 year f/u
- Results: No difference in re-rupture rate (3 total), no difference in functional scores, no infx
• Conclusions:

• “.....Controlled early motion is the most important part of treatment of ruptured Achilles tendon”

• Controlled early motion found to be safe!!!
Early Motion after Tendon Repair


• Conclusions: Early protected passive mobilization augments the physiologic processes that determine the strength and excursion of repaired flexor tendons
Figure 1: Tendon structure

- Collagen fibril
- Primary fibre bundle (subfascicle)
- Collagen fiber
- Tertiary fibre bundle
- Paratenon
Collagen arrangement
Early Range of Motion Makes Sense!

.....and, it appears to be safe
Early Weight Bearing after Repair of Achilles Rupture

- Suchak *JBJS (Am)*, 2008
- Level 1 study
- Early WB (2 weeks) vs Delayed WB (6 weeks) after surgical repair; Early ROM
  - No difference in re-ruptures (None!)
  - ~16% surgical complication rate, not well defined
  - Better early recovery in early WB group (socially, ADLs)
  - Only 6 month f/u
- Early WB after surgical repair is safe
Op vs Non-Op, Early WB/PT

- Willits, JBJS (Am), 2010
- Multicenter RCT, Level 1, 2 yr f/u
- 144 patients
- Operative vs Non operative
  - Both groups early WB (2 weeks) and early ROM [when?]
- Re-rupture ~4.6%; no difference b/t groups
  - Operative (2), Non Op (3)
- No clinically important difference b/t groups
- Non-op, early WB, early ROM a good option
Non-Operative treatment of Achilles Ruptures with Early ROM and Early WB appears to be as safe and effective as Operative treatment.
Non-operative Treatment...

- Barfod, *JBJS (Am)*, 2014 [Denmark]
- RCT, Level 1, 1 yr f/u
- Non Op, WBAT (day #1) vs NWB (6 weeks)
- Early ROM* both groups at 2 weeks
  - *PF to neutral, 5x/day
- No difference in outcomes
- **9% re-rupture** (3/26 WB, 2/25 NWB)!
- **40-50% strength deficit c/l limb at 1 year**
- Only 16% had returned to pre-injury level of play at 1 year
- Better early Quality of Life in the early WB group
Non-Op, Early WB, Cast

• Young, *JBJS (Am)*, 2014 [New Zealand]
• Level 1 RCT, 2 year f/u
• 2 groups both Non-Op, equinus cast for 8 wks
  – NWB x 8 wks
  – Early WB (Immediate?)
• Re-rupture 3% early WB, 5.7% NWB, NO DIFF
• Maybe early range of motion DOESN’T matter!
• *Patients excluded (and operated upon) if presented >72hrs after injury*
WHAT ABOUT FUNCTION?
Op vs Non-Op with early WB

- Olsson, *AJSM*, 2013 [Sweden]
- Level 1, RCT, Op vs Non-Op, 1 yr f/u
- Non-Op
  - WBAT, boot x 8 weeks
    - ***No ROM exercises for first 8 weeks!***
  - 10% re-rupture rate
- Op
  - WBAT, boot x 6 weeks, gentle AROM to -15° starting wk 2
  - 0% re-rupture rate, 12% superficial infections (Abx only)

- Subjective functional scores (ATRS, PAS) same b/t groups at 12 mos
- Both groups returned to previous level of play!
- Fxnl testing (hopping, drop-CMJ) worse at 12mos in non-op group vs op
• Lantto, *AJSM* 2016
  – RCT, level 1, Op vs non Op, N=60, 18mos f/u, recreational athletes
  – Early WB (1 week) both groups
  – ROM/PT started after 6 weeks*

• Results:
  – No difference in ankle scores (Leppilahti)
  – No difference in pain, stiffness, subjective strength, ROM
  – Isokinetic calf strength: Op 24% better at 6 mos, 15% better at 18mos
    • Neither group recovered to level of c/l side
  – RAND-36 Op > Non-op
  – Re-rupture 4 (14%) non-op, 1 (3%) Op  p > .05
  – Infection 1 (3%) Op group

• Conclusions:
  – Non-op treatment a reasonable option
  – Op vs Non-op similar subjective results, better and faster recovery of isokinetic calf strength with surgery, trend towards higher re-rupture rate if Non-Op

• Questions:
  – Did delayed ROM play a negative role in the non-op group?
So what’s the deal?

- Evidence is not clear if it is the early WB or the early ROM that gives modern day non-operative treatment good results.

- Regardless, Non-operative treatment (with early ROM and/or early WB) appears to be a very good option.

- Unclear if operative treatment produces better functional results....
Post-op Protocols

- Brumann, Injury, 2014
- Systematic review of RCT, post-op protocols

- “Immediate FWB leads to higher pt satisfaction, early RTW and RTP”
- “All functional parameters favor FWB, but not to statistical significance”
- “No increased re-rupture in early WB group”

- “Early ROM (at 2 weeks) superior to [cast] immobilization with earlier RTP and RTW and does not lead to higher re-rupture rate”
## Achilles Rupture Non-Operative Protocol

<table>
<thead>
<tr>
<th>Post Op Time:</th>
<th>Exercise Progression</th>
</tr>
</thead>
</table>
| **Day 0-14** | ▪ Equinus short leg cast, Non-weight bearing  
▪ Initiate straight-leg raises, quads sets, knee ROM exercise |
| **Day 14**   | ▪ Short leg cast removed  
▪ 20° elevated CAM walker placed  
▪ Boot to be worn while sleeping  
▪ Protected WB with crutches  
▪ Pt. to remove CAM for 5 minutes q hour, to perform Active dorsiflexion (to neutral only for 1st 6 weeks), passive plantar flexion from seated position.  
▪ Continue SLRs, quads sets |
| **Week 4-6** | ▪ Weight-bearing as tolerated (WBAT)  
▪ Maintain heel lift  
▪ Continue AROM DF (to neutral), PROM PF exercises  
▪ Continue SLRs, quads sets |
| **Week 6**   | ▪ D/C heel lift  
▪ No CAM walker at night  
▪ Continue exercises with therapist  
▪ Add gentle dorsiflexion stretches, no range restriction now  
▪ Gentle resistance exercises  
▪ Proprioception and gait training |
| **Week 8-12**| ▪ Wean from CAM walker (cane prn)  
▪ Over course of 4 weeks add bicycling, walking, elliptical  
▪ Add sports specific re-training at 12 weeks |
| **Week 16**  | ▪ Return to sporting activities at 4-6 months |

**PWB at 2 weeks**  
**WBAT at 4 weeks**  
**ROM at 2 weeks**
Achilles Tendon Repair Guidelines

<table>
<thead>
<tr>
<th>Post Op Time</th>
<th>Exercise Progression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days 1-12</td>
<td>- First 1.5 weeks <strong>NWB</strong>, splint</td>
</tr>
<tr>
<td></td>
<td>- Suture removal at 10-14 days, change splint to Cam Walker boot with 10 degree heel lift</td>
</tr>
<tr>
<td></td>
<td>- Initiate QS/SLR’s, Abd/Add, knee AROM</td>
</tr>
<tr>
<td>Week 2-4</td>
<td>- Initiate early, gentle AROM ankle dorsiflexion, gravity plantar flexion (boot removed, 3x/day)</td>
</tr>
<tr>
<td></td>
<td>- <strong>PWB</strong>, crutches, CAM Walker with heel lift</td>
</tr>
<tr>
<td>Week 4-6</td>
<td>- Begin <strong>WBAT</strong> after 4 wks, Cam Walker with 10 degree heel lift</td>
</tr>
<tr>
<td></td>
<td>- Remove Cam Walker daily for AROM exercises</td>
</tr>
<tr>
<td></td>
<td>- <strong>NO RESISTENCE EXERCISES</strong></td>
</tr>
<tr>
<td>Week 6-7</td>
<td>- Remove heel lift</td>
</tr>
<tr>
<td></td>
<td>- May begin to wean from Cam Walker at about 7 weeks</td>
</tr>
<tr>
<td></td>
<td>- Begin PT for gentle ROM, scar massage, modalities, edema control. <strong>GO SLOWLY.</strong></td>
</tr>
<tr>
<td>Week 8</td>
<td>- Progress PT to gentle A/AA/PROM, theraband, proprioceptive exercises, knee and foot AROM, home exercise program</td>
</tr>
<tr>
<td>Week 16</td>
<td>- If full strength, begin jogging</td>
</tr>
<tr>
<td>5-6 Months</td>
<td>- Begin agilities</td>
</tr>
<tr>
<td>6-8 Months</td>
<td>- Return to sports</td>
</tr>
</tbody>
</table>
Anecdotal Evidence (Level ∞)

- Med School Roommate #1 (Ortho MD, USC)
  - “Athletes need restoration of the tension, so I fix them all!”
  - “In L.A. it’s harder to talk people out of surgery....”
- Med School Roommate #2 (Ortho MD, Flagstaff)
  - Recreational outdoor athlete, tore his Achilles 1.5 yrs ago
  - Treated it non-op, early WB, early ROM
  - 8 mos: “no pain, no problems, I have jogged, but not yet sprinted or jumped.....”
  - 1.5yrs: “no limitations. I jog, I snowboard, I hike, I kick the soccer ball with my kids. I don’t play hoops anymore, but...”
  - “recommend Non op for recreational athletes. Pros??”

www.UOANJ.com
Summary Based on EBM Review

- Achilles ruptures may be treated non-operatively
- Operative treatment an option, but wound infection risk
- Re-rupture risk is diminished with early ROM and early WB in non-operative patients
- Operative and Non-operative treatment should include early WB and early ROM
- Early ROM and early WB are safe
- Regardless of treatment, a large # of athletes never return to prior level of play....
- Some MDs favor Operative treatment for high-level athletes
Clinical Question

• What is the optimal treatment for a recreational athlete with an acute Achilles rupture?

Non-operative treatment* with early protected weightbearing and early ROM

*If operative treatment chosen, early WB and early ROM should be utilized
THANK YOU!!!
Achilles References

Evidence Based Management of Acute Achilles Tendon Ruptures

Kenneth G. Swan, Jr., MD