

Chronic Achilles Tendon Rupture

Surgical reconstruction and post-operative outcomes

Akademisk avhandling

Som för avläggande av medicine doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet kommer att offentligen försvaras i R-Aulan, Sahlgrenska Universitetssjukhuset, Mölndal

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av

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Avhandlingen baseras på följande delarbeten

- I. Nilsson N, Nilsson Helander K, Hamrin Senorski E, Holm A, Karlsson J, Svensson M, Westin O. (2020) *The economic cost and patient-reported outcome of chronic Achilles tendon ruptures*. J Exp Orthop. 3;7(1):60. doi: 10.1186/s40634-020-00277-z.
- II. Nordenholm A, Nilsson N, Hamrin Senorski E, Nilsson Helander K, Westin O, Olsson N. (2022) *Patients with chronic Achilles tendon rupture have persistent limitations in patient-reported function and calf muscle function one year after surgical treatment – a case series*. J Exp Orthop. 9;9(1):15. doi: 10.1186/s40634-022-00451-5.
- III. Nilsson N, Gunnarsson B, Carmont MR, Brorsson A, Karlsson J, Nilsson Helander K. (2022) *Endoscopically assisted repair of chronic Achilles tendon ruptures and re-ruptures using a semitendinosus autograft is a viable alternative to pre-existing techniques*. Knee Surg Sports Traumatol Arthrosc. 30(7):2477-2484. doi: 10.1007/s00167-022-06943-2.
- IV. Nilsson N, Stensöta I, Nilsson Helander K, Brorsson A, Carmont MR, Concaro S. (2023) *Both gastrocnemius aponeurosis flaps and semitendinosus tendon grafts are effective in the treatment of chronic Achilles tendon ruptures – a systematic review*. (Submitted).
- V. Nilsson N, Alim Md A, Dietrich-Zagonel F, Concaro S, Brorsson A, Nilsson Helander K, Eliasson P. (2023) *Delayed Treatment of Achilles Tendon Ruptures Results in a Significant Downregulation in the Expression Patterns of MMPs and IL-6*. (Submitted).

SAHLGRENSKA AKADEMIN
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Surgical reconstruction and post-operative outcomes

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Abstract

When the treatment of Achilles tendon ruptures is delayed by more than 4 weeks, the rupture is classified as chronic. This thesis aims to examine the postoperative outcome of chronic Achilles tendon ruptures treated surgically in terms of long-term functional outcomes, patient-reported outcome measurements, biomolecular changes, and economic cost. Additionally, a new surgical technique for treating chronic Achilles tendon ruptures will be described and evaluated.

Study I: Fifty-nine patients that were surgically treated for a chronic Achilles tendon rupture with a gastrocnemius aponeurosis free flap were invited to participate in this study evaluating economic costs. The mean (SD) total cost for the treatment of a chronic Achilles tendon rupture was 6,494 € (6,508). This was 1,276 € more than the treatment of an acute Achilles tendon rupture. Study II: Twenty-two patients treated with a gastrocnemius aponeurosis free flap were evaluated one-year postoperatively. The median (range) ATRS was 67 (18-95) out of 100. The patients performed significantly worse on the injured than the healthy side in heel-rise repetitions and height. Calf circumference on the injured side was significantly smaller and the tendon was elongated compared with the healthy side. Study III: Twenty-two patients treated surgically with endoscopically assisted Achilles tendon reconstruction using a semitendinosus tendon autograft were included and evaluated at 12-months postoperatively. The patients reported a median (range) ATRS of 76 (45-99) out of 100. The median ATRA was significantly larger on the injured side and the tendon length significantly longer. Study IV: A systematic review of previous studies reporting postoperative outcomes of chronic Achilles tendon ruptures treated with a gastrocnemius aponeurosis flap or semitendinosus graft was performed. Out of the 818 studies identified, 36 studies justified the inclusion criteria. The mean (SD) ATRS was 83 (14) for patients treated with a gastrocnemius aponeurosis flap and 88 (6.9) for patients treated with a semitendinosus graft. Study V: Thirty-five patients that were surgically treated for acute (<4 weeks), short-term chronic (1-6 months) or long-term chronic Achilles tendon ruptures, each contributed tissue sample biopsies at the rupture site during surgical repair. RNA was extracted from the tissue samples using the TRIspin method and analyzed with RT-PCR. The mRNA levels for *COL1A1* and *COL3A1* were significantly higher in the short-term chronic rupture group compared with the acute group ($p<0.05$). *MMP-1* and *MMP-13* had both highest levels in the acute group ($p<0.001$) compared with the long-term chronic group. Inflammatory markers such as *IL-1*, *IL-6*, and *TNF- α* all had significantly higher mRNA levels in the acute group.

To conclude, chronic Achilles tendon ruptures imply high, but reasonable costs, acceptable functional outcomes with multiple surgical techniques. The chronic Achilles tendon ruptures also show lower mRNA levels that could imply more degradation which indicates that the surgical treatment of Achilles tendon ruptures should not be delayed more than necessary.

Keywords: Chronic Achilles tendon rupture. Semitendinosus graft. Tissue-sample. Achilles tendon re-rupture. Surgical repair. Gastrocnemius aponeurosis free flap. Health economics. Patient-reported outcome measurements.

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