

Achilles Tendon Ruptures

Predictors; functional and economic impact

AKADEMISK AVHANDLING

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

Fredag den 14 december klockan 09.00

av

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Fakultetsopponent:

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Avhandlingen baseras på följande delarbeten

- I. Westin O, Nilsson-Helander K, Grävare Silbernagel K, Möller M, Kälebo P, Karlsson J Acute ultrasonography investigation to predict reruptures and outcomes in patients with an Achilles tendon rupture. *Orthopedic Journal of Sports Medicine*. 14;4(10), 2325967116667920
- II Svedman S, Westin O, Aufwerber S, Edman G, Nilsson-Helander K, Carmont M, Karlsson J, Ackerman PW. Longer duration of operative time enhances healing metabolites and improves patient outcome after Achilles tendon rupture surgery *Knee Surgery Sports Traumatology Arthroscopy*. 2018 Jul;26(7):2011-2020
- III. Westin O, Nilsson-Helander K, Grävare Silbernagel K, Samuelsson K, Brorsson A, Karlsson J. Patients with an Achilles tendon re-rupture have long-term functional deficits and worse patient-reported outcome than primary ruptures. *Knee Surgery Sports Traumatology Arthroscopy*. 2018 Oct;26(10):3063-3072
- IV. Westin O, Svensson M, Nilsson-Helander K, Samuelsson K, Grävare Silbernagel K, Olsson N, Karlsson J, Hansson-Olofsson E. Cost-effectiveness analysis of surgical versus non-surgical management of acute Achilles tendon ruptures. *Knee Surgery Sports Traumatology Arthroscopy* 2018 Oct;26(10):3074-3082
- V. Hua A-Y, Westin O, Hamrin Senorski E, Svantesson E, Grassi A, Zaffagnini S, Samuelsson K, Svensson M. Mapping functions in health-related quality of life: mapping from the Achilles Tendon Rupture Score to the EQ-5D. *Knee Surgery Sports Traumatology Arthroscopy*. 2018 Oct;26(10):3083-3088
- VI. Westin O, Svedman S, Hamrin-Senorski E, Svantesson E, Nilsson-Helander K, Karlsson J, Ackerman PW, Samuelsson K. Older age predict worse outcome one year after an acute Achilles tendon rupture: A prognostic Multicenter study on 391 patients. *Orthopedic Journal of Sports Medicine* (accepted for publication)

SAHLGRENKA AKADEMIN
INSTITUTIONEN FÖR KLINISKA VETENSKAPER



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Predictors; functional and economic impact

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Abstract

Acute Achilles tendon rupture is a common injury, which leads to significant morbidity in patients. Many patients never recover their full function even after long rehabilitation, whereas others make a good recovery. The factors behind this are unknown. The optimal treatment strategy, whether or not to treat surgically, is still controversial. This thesis consists of six studies with the overall aim of finding predictors of outcome, examining the long-term follow-up of re-ruptures and comparing the cost efficiency of two different management strategies.

Study I is a cohort study of 45 patients who underwent acute ultrasonography within 72 hours of the index injury. They were randomly allocated to either surgical or non-surgical treatment. Three of four (75%) patients with a diastasis of more than 10 mm treated non-surgically sustained a re-rupture and these were the only re-ruptures in the study group. The patients with a diastasis of more than 5 mm displayed poorer heel-rise function and patient-reported outcome if treated non-surgically. Study II is a cross-sectional observational cohort study comprising 256 prospectively randomised patients. At two weeks post-operatively, patients underwent a micro-dialysis investigation and six metabolites were collected. Patients were followed up at three, six and 12 months and the duration of surgery was examined. The results showed that glycerol and glutamate were higher with a longer duration of surgery. Interestingly, a longer duration of surgery was correlated with an improved clinical and functional outcome. Study III is a long-term follow-up of patients with an Achilles tendon re-rupture, where validated outcome measurements were used to assess lower extremity function and symptoms. Twenty patients with a mean (SD) follow-up of 50.9 (38.1) months were included. This cohort was compared with patients (n=87) treated for primary ruptures. The injured side was significantly worse compared with the healthy side in terms of heel-rise tests. The most interesting finding in this study was that patients treated for a re-rupture reported a poorer patient-reported outcome compared with those treated for primary ruptures. Study IV is a health-economic evaluation comparing the cost-effectiveness of surgical and non-surgical treatments. The data were collected prospectively from a randomised controlled trial comprising 100 patients. This study showed that the cost per quality-adjusted life year (QALY) gained is € 45,855 and that surgical treatment is 57% likely to be cost efficient at a willingness to pay per QALY of € 50,000. Study V is a mapping study that develops an algorithm, which converts the Achilles tendon total rupture score (ATRS) to the European Quality of Life-5 dimensions Questionnaire (EQ-5D), which enables detailed health-economic studies related to Achilles tendon injuries. It concludes that the algorithm has a high goodness of fit and can be used in future studies. Study VI comprised 391 patients from five different randomised controlled trials predicting functional and patient-reported outcome one year after an acute Achilles tendon rupture. This study revealed that older age is a predictor of poorer outcome and that surgically treated patients have a tendency towards superior recovery in terms of heel-rise height.

Taken together, this thesis shows that ultrasonography could be potentially useful in predicting the risk of re-rupture and outcome in acute Achilles tendon rupture. It also demonstrates that a longer duration of surgery leads to the upregulation of healing metabolites. Patients who have sustained a re-rupture have long-term deficits in terms of function and a poorer patient-reported outcome than those with primary ruptures. Moreover, it provides the first cost-effectiveness analysis in this field of research and develops an algorithm for future health-economic studies. Finally, it concludes that older age is a strong predictor of poorer heel-rise height at one year.

Keywords: Achilles tendon rupture, re-rupture, predictors of outcome, health economics, Achilles tendon Total Rupture Score (ATRS)

ISBN: 978-91-7833-237-3

ISBN: 978-91-7833-238-0

<http://hdl.handle.net/2077/57423>