Henrica M. J. van der Linden-van der Zwaag ·
Rob G. H. H. Nelissen · Jan B. Sintenie

Results of surgical versus non-surgical treatment of Achilles tendon rupture

Received: 9 April 2004 / Accepted: 21 May 2004 / Published online: 7 July 2004
© Springer-Verlag 2004

Abstract Between 1990 and 2001, 292 patients with acute Achilles tendon rupture were admitted to our institution. Depending on the day of admission patients were allocated either to the Department of Trauma Surgery or to the Department of Orthopaedics. Two hundred and twelve patients (mean age 37 ± 9.4 years) were treated with surgical suture followed by plaster for 6 weeks. Eighty patients were treated non-surgically with splinting for 12 weeks. For both groups mean follow-up was 6 ± 3 years. There were 14 re-ruptures, ten after surgical repair and four after non-surgical treatment. In the surgical group there were seven major wound problems, 11 minor wound complications and six patients with complaints from the sural nerve. In the non-surgical group one patient suffered a pulmonary embolism after a re-rupture, 3 months after the initial rupture. There was no difference in mean ankle score and patient-satisfaction score between groups. Only 52% regained their original sports activity level, slightly better in the surgically treated group. With a non-significant difference in re-rupture rate but relatively more complications after surgical repair, non-surgical treatment is preferred. With a slightly better recovery of sports activity after surgical repair, this might be used as an argument for surgical treatment in young athletes.

Résumé Entre 1990 et 2001, 292 malades avec une rupture du tendon d'Achille ont été admis dans notre institution. Selon le jour de l'admission les malades ont été alloués au Département de Traumatologie ou au Département d'Orthopédie. 212 malades (âge moyen $37\pm 9,4$ ans)

ont été traité par suture chirurgicale suivie d'un plâtre pour 6 semaines et 80 malades ont été traités conservativement avec attelle pour 12 semaines. Pour les deux groupes la moyenne de suivi était de 6 ± 3 années. Il y avait 14 ruptures itératives, 10 après réparation chirurgicale et quatre après traitement non chirurgical. Dans le groupe chirurgical il y avait sept problèmes majeurs de paroi, 11 complications mineures de paroi et six malades avec souffrance du nerf sural. Dans le groupe non chirurgical un malade a eu une embolie pulmonaire après une rupture itérative, trois mois après la rupture initiale. Il n'y avait aucune différence dans le score moyen de la cheville et le score de satisfaction des malades entre les deux groupes. Seulement 52% ont regagné leur niveau d'activité sportive original, légèrement mieux dans le groupe traité chirurgicalement. Avec une différence non significative dans le taux des ruptures itératives mais relativement plus de complications après réparation chirurgicale, le traitement non - chirurgical est préféré. La récupération sportive légèrement meilleure après réparation chirurgicale est un élément de discussion pour le traitement chirurgical chez les jeunes athlètes.

Introduction

Achilles tendon ruptures (ATR) are seen more often in recent years, with an incidence ranging from 10 to 37 per 100,000 inhabitants [3, 6, 8, 13, 15]. In general middle-aged individuals are more prone to suffer from ATR [5]. The increase in sports-activities is only one of many plausible causes for the rising incidence. Other related factors are degenerative changes in the tendon itself and the existence of a hypo-vascular region near the calcaneal insertion which is prone to rupture after repetitive injuries [5, 7, 15].

Only four randomised studies exist, comparing non-surgical and surgical treatment [1, 16, 17, 22]. Two studies advocate the surgical approach, while two favour non-surgical treatment. The main reason for favouring one or the other treatment option is based on re-rupture rate.

H. M. J. van der Linden-van der Zwaag (✉) ·
R. G. H. H. Nelissen
Orthopaedic Surgery Department, Leiden University Medical
Center,
Leiden, The Netherlands
e-mail: enrike@vander-linden.nl
Tel.: +31-71-5263606
Fax: +31-71-5266743

J. B. Sintenie
Trauma Surgery Department, Medical Centre Alkmaar,
Alkmaar, The Netherlands

Comparison of other outcome factors is difficult due to variation in treatment and evaluation protocols.

Thus controversy exists on the ideal treatment protocol, but both non-surgical and surgical treatment protocols are probably viable. In our institution patients with ATR are treated surgical as well as non-surgical. The aim of this study was to evaluate the outcome of all patients treated in the hospital.

Patients and methods

All patient charts at the Leiden University Medical Centre registered in the central hospital database between 1990 and 2000 with the diagnosis of an Achilles tendon injury were evaluated. The complete ATR was acknowledged as presence of a palpable gap proximal to the tendon insertion in combination with a positive calf squeeze test. After having reviewed the charts, a total of 341 ATRs remained. Of the original 341 ATR patients, 49 were referred to another hospital for treatment, thus 292 patients were included in the review.

A total of 212 patients (154 men, 58 women) [(mean age 37 ± 9.4 years)] were treated with surgical repair. Another 80 patients (59 men, 21 women) were treated non-surgically. The mean age of this group was 42 ± 12.0 year.

In our hospital the treatment of ATR depends on the specialist on call. If an orthopaedic surgeon is on call (every Thursday and every fifth weekend), a non-surgical treatment is instituted. If a traumatologist is on call, surgical repair is performed. In this way a randomisation of the treatment was performed.

Surgical treatment consisted of an open surgical repair. In prone position under regional or general anaesthesia an incision was made medial to the midline in 174 patients and lateral to the midline in 48 patients. The ruptured tendon was restored by approximating the tendon fibres by a Bunnell suture technique using Vicryl (Ethicon) or PDS (Johnson & Johnson) suture. The tendon sheath was closed separately. Surgery was followed by a tape. A weightbearing cast was applied after 2 weeks and removed 6 weeks after surgery.

Non-surgical treatment consisted of a plaster cast with the ankle joint in plantar-flexion. Weightbearing was allowed after 2 weeks in a splint. The plantar-flexion was diminished after 8 weeks [19] and the splint removed after

a total of 12 weeks. In both groups participation in sports was not allowed for another 3 months. Both treatment protocols remained unchanged during the period from 1990 to 2000.

Medical records of all patients were reviewed for: age at time of ATR, gender, cause of the rupture, time of rupture after onset of sports activity, treatment (in case of operative treatment: incision, suture, delay operation, complications related to surgery), duration of immobilisation, re-rupture, sport-activity before and after ATR and patient-satisfaction.

The mean follow-up of both surgical (212 patients) and non-surgical (80 patients) treated group was 6 ± 3.0 year. Before rupture 25 patients had some kind of complaints from the Achilles tendon. None had received local steroid-injections [20].

At time of follow-up all patients received a questionnaire by mail, based on the Ankle score from Leppilathi [9]. One hundred thirty-one surgical treated patients and 48 non-surgical treated patients completed the questionnaire. Statistical analysis encompassed means and standard deviations between groups, non-parametric test were performed between groups. Student's *t*-tests were performed to analyse differences in age.

Results

The mean age of patients was 38 years (range 15–82 years). In the majority (88%) a sports related injury preceded the ATR, most often during soccer, tennis or badminton. The majority of ruptures (57%) occurred 30 min or more after start of the sports activity.

In 174 patients the rupture was on the left side. In one third this was the dominant side. Four patients suffered from a bilateral ATR. The time between first and second ATR varied from 1.5 to 5 years. Ruptures were found more often in males than in females, which is in concordance with earlier epidemiological studies [15].

The mean age was significantly different in the two groups (Table 1). While all non-surgically treated patients received a plaster cast immediately, surgical intervention was performed within 24 h in 203 patients, and within 48 h in the remaining.

At time of re-rupture the mean follow-up was 10 months. Re-rupture was seen in four patients in the non-surgical group and in 10 patients in the surgical group.

Table 1 Comparison of surgical and non-surgical treated groups

	Total ATR	Surgical treatment	Non-surgical treatment	Significance
Number	292	212	80	
M/F ratio	7:3	7:3	7:3	No
Mean age	38 ± 10.0 yr	37 ± 9.4 yr	42 ± 12.0 yr	Yes (p 0.009)
Re-rupture (numbers)	14	10	4	No
Complications (numbers)	26	24	2	Yes (p < 0.05)
Mean total score	58	58 ± 11.6	58 ± 12.3	No
Return to previous sport activity	52%	60%	49%	$p=0.09$

Time of onset, cause and treatment of the re-ruptures are shown in Table 2.

Thirty-two patients had complications related to the operation. There were seven major wound problems (deep infection, skin necrosis or fistula) and 17 minor complications (seven superficial wound problems, two wound dehiscence, two scar-adhesions, and six patients with disturbances of sensibility in the area of the sural nerve).

One patient treated non-surgically suffered a pulmonary embolism during oral anticoagulant therapy after a re-rupture, 3 months after the initial rupture. The patients suffering from complications did not differ from patients without complications with respect to age and gender. None of the patients with complications had a systemic disease, previous symptoms or injections with corticosteroids.

The mean total score (max 70 points) was not significantly different in the two groups. Patients with complications scored 50 ± 13.1 points, while patients without complications scored a mean of 59 ± 11.7 points.

Among surgical treated patients the return to sports was more often seen than among non-surgical treated patients ($p=0.09$, 2-tailed Mann–Whitney). Only 52% regained their original sports activity level. The patient-satisfaction score did not differ. Fourteen patients suffered a re-rupture (Table 2). In ten patients the re-rupture was treated as the initial rupture. The mean score after re-rupture was 55 ± 10.2 points.

Discussion

During the past decades many studies have been published dealing with the treatment of Achilles tendon rupture [11]. We found however only four randomised studies [1, 16, 17, 22] (Table 3). Our retrospective study showed no significant differences in functional scores after surgical and non-surgical treatment.

The largest and longest randomised prospective study of Nistor [17] included 105 patients and showed 4% re-ruptures in surgical treated patients compared to 8% in non-surgical treated patients. However the surgical group

showed a large number of secondary complications. Nistor recommended non-surgical treatment because of the lower morbidity and shorter hospital-stay.

Cetti [1], in a study of 111 patients, found 9% complications and 5% re-ruptures in the surgical group and 16 and 15%, respectively, in the non-surgical group. The differences were however not found to be significant. Cetti concluded that operative treatment is superior because of better recovery to sports-activity, less atrophy and fewer complaints.

In the relatively small group of 50 patients, Thermann [22, 23] used a new developed post-operative applied boot. There were no significant differences between the surgical and non-surgical groups, neither functional nor in the course of healing. He concluded that non-surgical treatment allowed for a shorter period of rehabilitation.

Moller [16] found a much higher incidence of re-ruptures in the non-surgically treated patients. However the surgical and non-surgical treatment produced equally good functional results, if complications were avoided.

A problem in comparing the results is the lack of a protocol for subjective and objective evaluation of the ATR. The use of diagnostic ultrasound during post-operative follow-up to assess recovery has been suggested by some authors [12, 18, 21]. None of the prospective studies mentioned earlier are using the same protocol.

An important end-point is the occurrence of re-ruptures. After surgical treatment the percentage of re-ruptures varies from 0.4% to 2.5% and after non-surgical treatment from 10.6% to 17.7% [1, 17, 22, 25].

Our study shows that re-rupture can occur more than 12 months after the initial rupture. The length of follow-up might thus influence the reported rate of re-rupture. Our follow-up was longer than the one of Cetti [1] and Thermann [21], and we also found a higher re-rupture rate.

Most complications in surgically treated patients are wound problems and this is seen as the greatest disadvantage of surgical treatment [2, 10, 24, 25]. We found a relatively high complication percentage of 11% in the surgically treated group. Leppilahti [9] considered these complications to be of little importance in comparison with the higher re-rupture rate in non-surgical treated

Table 2 Re-ruptures

Nr	Sex	Age at time of rupture	Initial cause	Initial treatment	Re-rupture after	Cause re-rupture	Treatment of re-rupture
1	M	46	Misstep	Non-surgically	2 m	Misstep	Non-surg.
2	M	42	Badminton	Surgically	4 yr	Badminton	Surg.
3	M	21	Badminton	Surg.	2 yr	Badminton	Surg.
4	M	39	Soccer	Surg.	2 m	Misstep	Surg.
5	F	15	Wound	Surg.	2 m	Fall	Surg.
6	F	23	Korfbal	Non-surg.	5 m	?	Non-surg.
7	M	38	Tennis	Surg.	2 m	Fall	Non-surg.
8	M	26	Badminton	Surg.	2 yr	Badminton	Surg.
9	M	33	Basketball	Surg.	2 m	Fall	Surg.
10	M	35	?	Non-surg.	3 m	?	Non-surg.
11	M	29	Basketball	Surg.	2 m	Misstep	Non-surg.
12	M	29	Misstep	Surg.	5 m	?	Surg.
13	M	35	Soccer	Non-surg.	6 m	Soccer	Surg.
14	M	42	Misstep	Surg.	8 m	Tennis	Surg.

Table 3 Other randomised studies comparing surgical and non-surgical treatment of ATR

References	Year of Publ.	Numbers treated, ns/s	FU (mths)	Re-rupture, ns/s	Other Compl., ns/s
Nistor [17]	1981	60/45	30	5/2	0/29
Cetti [1]	1993	56/55	12	7/3	3/15
Thermann [22]	1995	22/28	12	0/0	0/3
Moller [16]	2001	53/59	24	11/1	2/10

ns non-surgical, s surgical.

patients. However, wound problems cause additional morbidity, extra surgical intervention and frequent out-clinic visits. And besides, in our study the group with surgical complications scored less than patients without complications (50 vs 59 points).

In order to overcome the wound complications percutaneous repair has been considered. In a prospective randomised trial including 73 patients with a follow-up of 2.5 years Majewski [14] compared operative end-to-end suture with percutaneous repair or non-surgical treatment. The percutaneous repair showed the lowest weakening of muscle force and the highest patient-satisfaction, and the patients returned sooner to work and to sports. In our study there was no difference in functional scores between surgical and non-surgical treated patients.

In our study 88% of ATR were caused by sports activity and in most cases occurred more than 30 min after starting the sports activity. This is in agreement with earlier studies from Jozsa [5] and Moller [15]. Return to the original sports activity level seems to be better after surgical treatment. The younger age of the patients in our surgical group may however also have influenced the result.

None of our patients had preceding signs or symptoms in the Achilles tendon area. And although it is often mentioned Jarvinen [4] found no relationship between such symptoms and rupture.

The number of re-ruptures after surgical or non-surgical treatment was not significantly different in our study. However, the surgical procedure had an additional complications rate of 11%. There was a tendency that a higher percentage of surgically treated patients reached their pre-operative sport activity level than did patients treated without surgery.

In conclusion, this study adds to evidence that a well-conducted non-surgical treatment protocol gives a good clinical outcome and the re-rupture rate is not higher than after surgical treatment. A further major advantage of non-surgical treatment is the avoidance of wound problems.

References

- Cetti R, Christensen SE, Ejsted R et al (1993) Operative versus non-operative treatment of Achilles tendon rupture. *Am J Sports Med* 21:791–799
- Fierro NL, Sallis RE (1995) Achilles tendon rupture. Is casting enough? *Postgrad Med* 98:145–152
- Houshian S, Tscherning T, Riegels-Nielsen P (1998) The epidemiology of Achilles tendon rupture in a Danish county. *Injury* 29:651–654
- Jarvinen TA, Kannus P, Paavola M, Jarvinen TL, Jozsa L, Jarvinen M (2001) Achilles tendon injuries. *Curr Opin Rheumatol* 13:150–155
- Jozsa L, Kvist M, Balint BJ, Reffy A, Jarvinen M, Lehto M, Barzo M (1989) The role of recreational sport activity in Achilles tendon rupture. A clinical, pathoanatomical, and sociological study of 292 cases. *Am J Sports Med* 17:338–343
- Leppilahti J (1996) Achilles tendon rupture, with a special reference to epidemiology and results of surgery. Thesis, University of Oulu, Finland
- Leppilahti J, Orava S (1998) Total Achilles tendon rupture: a review. *Sports Med* 25:79–100
- Leppilahti J, Puranen J, Orava S (1996) Incidence of Achilles tendon rupture. *Acta Orthop Scand* 67:277–279
- Leppilahti J, Forsman K, Puranen J, Orava S (1998) Outcome and prognostic factors of Achilles rupture repair using a new scoring method. *Clin Orthop* 346:152–161
- Lo IK, Kirkley A, Nonweiler B, Kumbhare DA (1997) Operative versus nonoperative treatment of acute Achilles tendon ruptures: a quantitative review. *Clin J Sport Med* 7:207–211
- Maffulli N (1999) Current concepts review: rupture of the Achilles tendon. *J Bone Joint Surg Am* 81-A:1019–1036
- Maffulli N, Dymond NP, Regine R (1990) Surgical repair of ruptured Achilles tendon in sportsmen and sedentary patients: a longitudinal ultrasound assessment. *Int J Sports Med* 11:78–84
- Maffulli N, Waterston SW, Squair J, Reaper J, Douglas AS (1999) Changing incidence of Achilles tendon rupture in Scotland: a 15-year study. *Clin J Sport Med* 9:157–160
- Majewski M, Rickert M, Steinbuck K (2000) Achilles tendon ruptures. A prospective study assessing various treatment possibilities. *Orthopäde* 29:670–676
- Moller A, Astron M, Westlin N (1996) Increasing incidence of Achilles tendon rupture. *Acta Orthop Scand* 67:479–481
- Moller M, Movin T, Granhed H, Lind K, Faxen E, Karlsson J (2001) Acute rupture of tendon Achilles. A prospective randomised study of comparison between surgical and non-surgical treatment. *J Bone Joint Surg Br* 83:843–848
- Nistor L (1981) Surgical and non-surgical treatment of Achilles tendon rupture. *J Bone Joint Surg Am* 63:394–399
- Rominger MB, Bachmann G, Schulte S, Zedler A (1998) Der wert von Ultraschall und Magnetresonanztomographie in der postoperativen Verlaufskontrolle nach Achillessehnenruptur. *Rofo Fortschr Geb Rontgenstr Neuen Bildgeb Verfahren* 168 (1):27–35
- Saleh M, Marshall PD, Senior R, MacFarlane A (1992) The Sheffield splint for controlled early mobilisation after rupture of the calcaneal tendon. A prospective randomised comparison with plaster treatment. *J Bone Joint Surg Br* 74:206–209
- Shrier I, Matheson GO, Kohl HW (1996) Achilles tendonitis: are corticosteroid injections useful or harmful? *Clin J Sport Med* 6:245–250
- Thermann H, Zwipp H, Milbradt H et al (1989) Die Ultraschallsonographie in der Diagnostik und Verlaufskontrolle der Achillessehnenruptur. *Unfallchirurg* 92:266–273
- Thermann H, Zwipp H, Tscherne H (1995) Funktionelles Behandlungskonzept der frischen Achillessehnenruptur: zwei Jahres Ergebnisse einer prospektiv-randomisierten Studie. *Unfallchirurg* 98:21–32
- Thermann H, Hufner T, Tscherne H (2000) Achilles tendon rupture. *Orthopäde* 29:235–250
- Wills CA, Wasbrun S, Caiozzo V et al (1986) Achilles tendon rupture: a review of the literature comparing surgical versus non surgical treatment. *Clin Orthop* 207:156–163
- Winter E, Weise K, Weller S, Ambacher T (1998) Surgical repair of Achilles tendon rupture: comparison of surgical with conservative treatment. *Arch Orthop Trauma Surg* 117:364–367