RUPTURE OF THE CALCANEAL TENDON
THE EARLY AND LATE MANAGEMENT

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We have reviewed 106 patients after treatment for spontaneous rupture of the calcaneal tendon, and assessed the clinical results including the power of plantarflexion. In patients treated within 48 hours of injury the result was very similar in conservatively and in operatively treated patients. The incidence of major complications was higher after operation (17%) than in those treated conservatively (4%). Patients who were treated more than one week after injury, however, had an inferior result with respect to power of plantarflexion after conservative management.

It is therefore recommended that calcaneal tendon rupture is treated conservatively with a plaster in full equinus when it is diagnosed within 48 hours of injury, and by operation when diagnosis has been delayed for more than one week.

Hippocrates’ view of rupture of the calcaneal tendon was "that this tendon, if bruised or cut, causes the most acute fevers, induces choking, deranges the mind and at length brings death". Although today we would offer a better prognosis, treatment remains controversial despite many publications.

The traditional view was stated by Quenu and Stolianovitch in 1929, when they compared the results of conservative and operative treatment, and stated that "rupture of the Achilles tendon should be operated on and operated on without delay". Analysis of their series, however, showed that the conservatively treated patients were in effect untreated. Two further series (Christensen 1953; Arner, Lindholm and Orell 1958–59) similarly compared untreated with operated cases and then condemned conservative management.

Lea and Smith (1968) were stimulated by reports which suggested powers of natural repair in the calcaneal tendon of both animals (Lipscomb and Wàkim 1961; Conway, Dorner and Zuckner 1967) and man (Boyd et al. 1949; Saunders, Hochberg and Wittenborn 1978). They presented good results from conservative treatment as opposed to no treatment. Lea and Smith reported a larger series in 1972 and other authors confirmed their good results (Lilholt and Munch-Jørgensen 1976; Stein and Lueckens 1976; Termansen and Damholt 1979; Nistor 1981).

Opponents of conservative treatment argue that this gives a high rate of re-rupture, and this is supported by a review of published papers. We were able to collect reports of 229 conservatively treated cases from the literature (see list of references); they had a re-rupture rate of 17.9% compared with a rate of 2.2% in reports of 587 operated cases. However, operation carries a significant incidence of other major complications such as skin or tendon necrosis, and of lesser complications such as wound infection and nerve damage. The 587 operated cases had a major complication rate of 12.3% and a minor complication rate of 19.4%.

The other objection to conservative treatment is that it results in reduced strength of plantarflexion. We found five comparative reviews in the literature; three (Gillies and Chalmers 1970; Edna 1980; Nistor 1981) compared the results of early conservative with operative treatment and reported similar results from each group. The other two (Inglis et al. 1976; Jacobs et al. 1978) did not take account of delay in instituting treatment and reported inferior results for conservative management.
We have not found a report which compares the results of early conservative treatment (within 48 hours), delayed conservative treatment (over 48 hours) and treatment by operation. The aim of this paper is to present these comparisons.

PATIENTS AND TREATMENT

Cases of rupture of the calcaneal tendon treated at certain hospitals in Edinburgh and Greater Manchester from 1969 to 1981 were studied. The records of 177 ruptures in 174 patients were reviewed. The average age of the patients was 44.2 years (16 to 84 years) and two-thirds were male. Follow-up was for a minimum of one year and averaged five years.

In all, 103 patients with 106 ruptured tendons attended for review and assessment. The rupture was left-sided in 58 and on the right in 48. The mechanism of injury in most cases was within the well recognised pattern of jumping, pushing off with the injured limb, or a significant fall, but five patients had been injured during a sustained pushing effort, involving a car or a rugby scrum. This is a previously unreported mode of injury. It was also noted that calcaneal tendon rupture in men of over 70 years of age seemed to occur with minimal trauma.

Most injuries were sustained during some sort of athletic pursuit or dancing, although the majority of patients were relatively inactive, taking such exercise only once or less per week. None of them had had a local steroid injection before the rupture, although one patient was on systemic steroid therapy for a respiratory complaint.

Treatment was started later than 48 hours after injury in 29.8% of the reviewed patients. In 18.2% this delay was due to a missed diagnosis by a medical practitioner. Conservative treatment was generally with a full equinus plaster for four weeks followed by a semi-equinus plaster for another four weeks. A heel raise was then worn for a further four weeks after removal of the plaster. Since treatment had been carried out in a number of units, there were some slight variations from this regime, and two patients in the late group had plaster in the semi-equinus position for six and eight weeks respectively.

The usual operative technique was end-to-end suture, but various types of aponeurotic flaps were used in a few of the delayed group. A number of different suture materials were employed for repair and the regime of immobilisation in plaster varied according to the unit involved in the treatment.

METHOD OF REVIEW

All of the 103 patients were reviewed by one author (DGC). Details of treatment and complications were obtained from the case notes and confirmed with the patients. The period before each patient became fit for work, for sport and completely symptom-free was noted, as was the duration of inpatient treatment. Clinical examination included assessment of the thickening of the healed tendon, the calf circumference and the range of movement at the ankle; the range of dorsiflexion, in particular, was noted in order to assess whether the tendon had lengthened.

The strength of isometric plantarflexion was measured with a device developed with the help of the Biomechanical Department of Salford University. This device was tested initially on 25 normal subjects and shown to give a reproducible comparison between the lower limbs, providing that allowance was made for the "dominant" limb. The results have been expressed as a percentage of the strength on the uninjured side.

Finally, a subjective assessment of the result was obtained by asking the question, "Are you completely satisfied with the result of your treatment?", and the reason for a negative answer was established.

RESULTS

The results were analysed in two groups, those patients treated early (within 48 hours of injury) and those treated late.

Early treatment. There were 73 calcaneal tendon ruptures in 71 patients in this group, and 37 of them in 36 patients had been treated conservatively. The average ages of the conservative and operated groups were similar, 43 years and 42.7 years respectively, as were their age and sex distribution (Table I), their levels of activity and their type of occupation before the injury. Clinical results. The results from the two groups are compared in Table I. Patients treated conservatively were not usually admitted to hospital, but in one case admission for seven days was required for a deep venous thrombosis. This accounts for the average of 0.19 days in hospital for the group. Patients with appropriate occupations could return to work on the same or the next
day after plaster treatment, whereas the other group had to recover from their operation before being fit to return to similar occupations.

The objective results (Table II) are comparable in the operative and conservatively treated patients, except that thickening of the tendon was confirmed to be less evident after conservative treatment. Healing with lengthening of the tendon was seen in comparable numbers in both groups and the extent of the increase in individual patients was also similar. The average strength of plantarflexion on the injured side was comparable for both groups as was the number of patients with significant weakness (over 10% less power than the normal side).

Complications. There were no instances of re-rupture in any of the reviewed patients receiving early treatment. Complications were assessed not only in the patients who attended for review but also in the whole series, giving an additional 39 conservatively and 20 operatively treated patients. Of 76 patients treated in plaster, three had major complications (two deep venous thromboses and one re-rupture), a rate of 3.9%. Of 56 operated patients six had major complications (two re-ruptures, two re-operations for removal of wire suture and two skin necroses), a rate of 16.6%. The rate of re-rupture in the whole early series was 1.3% for conservative treatment and 3.9% after operation. Minor complications (small plaster sores) occurred in three of the 76 conservatively treated patients, giving a rate of 3.9% and in eight of 56 surgical patients (five with delayed wound healing, two with sural nerve lesions and one minor plaster sore), a rate of 22.2%.

Late treatment. There were 31 patients with unilateral calcaneal tendon ruptures in this group (Table III); 14 had been treated conservatively and 17 operatively. The conservative treatment of five patients and the operation on three had been within one week of injury and in the remainder from one to eight weeks.

The average age of the conservatively and operatively treated patients was 54 years and 40.2 years respectively, not as well matched as the groups of "early" patients. However, analysis of the results in the whole series failed to show any correlation between age and result.

End-to-end suture of the tendon was performed at 13 of the 17 operations, the plantaris tendon being used to reinforce the repair in four of these. Various techniques involving the aponeurosis of the gastrocnemius were used in the other four cases. The suture material was absorbable in six cases and non-absorbable in 11. The average time in plaster was 7.7 weeks, the foot being placed in full equinus in 13 patients.

For those treated conservatively, the programme was similar to that for the early cases.

Clinical results. The results are summarised in Table IV. Although the average periods before fitness for work and sport are listed, many of the conservatively treated group had retired from work and did not play sports. The difference in strength of plantarflexion was significant: the operated group averaged 91.1%, a figure comparable to that achieved with either type of early treatment, but the conservatively treated group averaged only 80%. The result was worse in those nine patients whose treatment had started more than one week after injury, averaging 74%. This difference was not seen in the operated group.
Complications. There was one case of re-rupture among the conservatively treated patients and none in the operated patients. Again, the incidence of complications was assessed from the case notes of those patients not reviewed, which added two patients treated conservatively and nine treated surgically. Major complications occurred in three of the 16 patients treated conservatively (one re-rupture, one with fixed equinus deformity and one failure of tendon healing) and in three of the 26 surgically treated patients (three wound problems requiring skin grafts). Minor complications were seen in one of 16 conservatively treated patients (a minor plaster sore) and seven of 26 surgically treated patients (two sural nerve lesions, two plaster sores, two delayed wound healing and one reaction to epidural anaesthesia). Two patients who had had no specific treatment for their injury both had poor results on both objective and subjective assessments.

**DISCUSSION**

The sex ratio was unexpected, there being a considerably larger proportion of females than that reported in previous series. Two recent large series from the USA (Inglis and Sculco 1981) and Scandinavia (Nistor 1981) reported male to female ratios of 7.6:1 and 8.7:1 respectively. The ratio of 2:1 in our series could be inaccurate because not every patient who presented to the hospitals involved was traced, but it is very unlikely to be inaccurate to the degree implied by these figures. It seems, therefore, that there may be a different sex distribution in the British Isles.

Patients treated within 48 hours of injury had as good results as any previously reported. Similar numbers of well-matched patients were treated conservatively or operatively, with selection only by the treatment policy of the unit to which they presented. The objective results for the two types of treatment of the "early" group are indistinguishable, apart from the increased thickening of the tendon associated with operative treatment, and in particular, there was no difference in the isometric strength of plantarflexion. Conservative treatment, of course, does not require admission or anaesthesia and the patients are able to return to work sooner.

The subjective results were rather better in conservatively treated patients. Only three of 36 were not satisfied with the result, whereas 15 out of 35 patients treated surgically were not completely satisfied. In three conservatively treated patients the subjective result was so good that they could not remember which side had been injured.

The incidence of re-rupture was comparable for the two groups, but the overall complication rate was much higher for those who had an operation. While it could be argued that the complication rate might be reduced with better surgical technique, it must be accepted that conservative treatment gives as good results and has a lower complication rate, even when an ideal treatment regime is not strictly followed.

The relative merits of the two forms of treatment were summed up by a patient who had bilateral ruptures, one treated conservatively and the other by operation, with excellent results on both sides. When asked which treatment he would prefer in the event of a further rupture, he replied "Well, I'd rather not have an operation".

Patients whose treatment started three or more days after their injury did not provide matched series for the two treatment methods, particularly in respect of age, but the few patients treated between three and seven days by either method had as good results as those treated early.

However, the result of conservative treatment started more than one week after injury was inferior in respect of strength of plantarflexion. This result of delay was not unexpected because both clinical experience and histological studies (Arner et al. 1958–59) indicate that after one week enough granulation tissue will have developed to prevent apposition of the tendon ends.

The incidence of re-rupture after conservative treatment in this series is lower than that previously reported. In our series, a foot position in full equinus was used, as against the "gravity equinus" position recommended by Lea and Smith (1972) and used in most other series. All patients in the early group achieved a full range of movement of the ankle and foot without difficulty. It would therefore seem reasonable to recommend full equinus for the first plaster, changing to a semi-equinus or gravity equinus position after four weeks.

A long leg plaster to neutralise the gastrocnemius and facilitate apposition of the tendon ends would seem to be theoretically desirable, but in our series less than one-third of the conservatively treated patients in the early group had a long cast. Our analysis revealed no relationship between a long leg cast and an improved result.

In conclusion, we recommend that a spontaneous rupture of the calcaneal tendon presenting within 48 hours of injury is treated conservatively by four weeks in a full equinus plaster followed by a further four weeks in a semi-equinus cast. A heel raise should be used for the first four weeks after removal of the cast. A patient who presents more than one week after injury will obtain a better result after operative treatment. Between three and seven days, conservative management is probably appropriate, but a definite recommendation cannot be made on the evidence available.

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