

Contralateral tendon rupture risk is increased in individuals with a previous Achilles tendon rupture

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The purpose of this study was to examine the outcome after surgery for an acute Achilles tendon rupture. In particular, we wanted to study whether persons who have suffered an Achilles tendon rupture are at greater risk of a contralateral tendon rupture. From September 1990 to April 1997, 168 acute Achilles tendon ruptures in 26 women and 142 men were treated operatively. In August 1998 (median: 4.2 years post injury), 154 of these patients (92%) responded to a follow-up questionnaire. Local symptoms (pain, decreased strength and/or reduced range of motion) were reported pre

injury by 25% of the patients; at follow-up this had increased to 52%. Ten patients (6%) experienced a rupture on the contralateral side during the follow-up period (OR: 176 [70–282] vs. the expected rate based on the general population risk of this injury, $P < 0.001$). Thus, this study suggests that patients with an Achilles tendon rupture are at significantly increased risk of a contralateral tendon rupture, as well. Also, as many as half of the patients suffered from post-injury problems at long-term follow-up.

Ruptures of the midsubstance of the Achilles tendon typically occur in 30–50-year-old male recreational athletes engaged in vigorous activities (Maffulli, 1999; Moller, 2001). Evidence-based methods to prevent Achilles tendon tears do not exist (Maffulli, 1999), although some sports-specific research suggests that the use of proper shoe-wear, avoidance of high-risk sports and exercise programs for the calf muscles may prevent injury (Jorgensen & Winge, 1990). However, since so little is known about possible risk factors the effect of these measures are uncertain (Maffulli, 1999). Since the incidence of tendon ruptures is higher in Western countries than in Africa and East Asia, it has been proposed that a genetic factor may be involved (Moller et al., 1996; Jozsa & Kannus, 1997). The apparent association between tendon rupture risk and blood group 0 (Jozsa et al., 1989a) appears to support this suggestion. However, not all studies have demonstrated the same association with blood group 0 (Leppilahti et al., 1996; Maffulli et al., 2000b). An increase in the rate of Achilles tendon ruptures during the last decade also indicates that environmental factors may have changed, such as increased participation in high-load sports activities in high-risk age groups (Moller et al., 1996; Jozsa & Kannus, 1997).

If inherent factors exist that put some individuals at higher risk of an acute Achilles tendon injury, it may be hypothesized that persons who have suffered an Achilles tendon rupture are at greater risk of a contralateral tendon rupture. To test this hypothesis, we surveyed a cohort of patients previously operated for a tendon rupture, and compared the rate of contralateral tendon ruptures with the expected rate of Achilles tendon ruptures in the general population. In addition, we wanted to examine the outcome in this surgically treated patient group.

Material and methods

A total of 168 patients with an acute closed Achilles tendon rupture submitted to the Akershus University Hospital from September 1990 to April 1997 were identified from hospital records. The cohort consisted of 26 women and 142 men with a median age at injury of 38.5 years (range: 16–82 years). This hospital was responsible for providing acute surgical care for a population of 320 000 people. Each hospital in Norway serves a well-defined population, and it is highly unlikely that patients were referred to other hospitals for this type of injury.

Surgery was the treatment of choice for all Achilles tendon ruptures at our hospital, and all patients in this study were operated on no later than 6 days from the time of injury. A posteromedial approach, followed by an end-to-end Kessler suture was the standard operative procedure performed in

either spinal or local anesthesia. Post operatively, a plaster cast with 90° dorsiflexion of the ankle was used for 6 weeks, while the patients were using crutches to avoid excessive loads on the sutured Achilles tendon. The plaster cast was then removed, and the patients were advised to increase weight bearing gradually to recover normal daily activities within 12 weeks. Just after cast removal, the patients were instructed in functional closed-chain exercise by the hospital physical therapist. Full weight bearing without crutches was allowed after 8 weeks. Easy running was allowed after 3 months, and patients were asked to avoid sports demanding explosive muscle power for 6 months.

A questionnaire addressing the causes of the index injury, post-injury problems and the ability to return to their previous level of sports participation was mailed to the patients in August 1998. The patients were asked to self-report whether they suffered from post-injury problems, such as reduced strength and reduced range of motion, compared with the non-injured side. The patients were also asked about contralateral Achilles tendon ruptures, and this information was cross-referenced with hospital records. One hundred and fifty-four patients responded to the questionnaire (92%). Five patients had left the country, one was dead and eight patients did not want to participate. One of these suffered bilateral Achilles tendon ruptures as his index injury.

A χ^2 test was used to compare the expected rate of Achilles tendon ruptures based on the incidence for an acute Achilles tendon rupture in the population observed in this study with the risk of a subsequent contralateral tendon rupture in the study group. We have assumed that the injury incidence was unchanged during the decade covered by the study, and the general population incidence found in this study is in line with previously reported numbers from Norway (Helgeland, 1997). A McNemar test for paired proportions was used to compare the prevalence of pre- and post-injury problems. *P*-values of less than 0.05 were regarded as statistically significant.

Results

The overall incidence of this injury in this population of 320 000 inhabitants was estimated to be eight per 100 000 inhabitants per year. Ten of the 168 patients (6%) experienced an acute rupture of the contralateral Achilles tendon during the follow-up period (4.2 years). This corresponds to an incidence of 1410 injuries per 100 000 persons per year in this selected population. The odds ratio compared with the general population was 176 (95% confidence interval: 70–282, *P*<0.001). The contralateral tendon rupture occurred with a median delay of 3.1 years (range: 1–7) after the primary injury. Nine of the ten patients who suffered a contralateral tendon rupture were blood group B Rh+. Complete information on blood types was not available for the rest of the cohort.

Sport was the major activity (74%) reported at the time of the primary Achilles tendon rupture (soccer 29%, team handball 16%, squash 7%). In 39% of the cases, a forceful short run was the intended move at the time of injury. Seven percent reported landing and 7% jumping as the cause of the injury. A combination of these mechanisms was reported in

17% of the cases, while 30% did not respond to this question.

Pre-injury symptoms – tenderness and periods of impaired function – were reported by 25% of the patients. At follow-up pain was reported by 29% of the patients, reduced strength by 26% and reduced range of motion compared with the other side by 26% of the patients. The post-injury symptom prevalence was 52% (*P*<0.001, McNemar test). Thirty-one percent of the patients reported that they were unable to return to their pre-injury sport due to post-injury problems.

Complications were noted by 14 patients (8%), including seven patients with wound infections, three patients with skin adhesions and one patient suffering from deep venous thrombosis. In addition, three patients (2%) experienced partial or total reruptures at three to 6 months post injury. All the reruptures were treated non-surgically.

Discussion

The principal finding of the present study was that there was a vastly increased risk of a rupture of the contralateral Achilles tendon in patients who had previously suffered a rupture on one side. This is a novel observation, which could have several explanations. An obvious suggestion is that there may be a genetic predisposition for tendon ruptures. Studies which show an association with blood group 0 and increased cholesterol levels appear to support this view (Jozsa et al., 1989a, Mathiak et al., 1999). However, these findings have not been confirmed in other studies (Maffulli et al., 2000b) and the predominant blood type in the group with contralateral ruptures in the current study was B Rh+.

An alternative explanation could be that the injury is caused by degenerative changes (Khan et al., 1999). In support of this, recent studies have demonstrated degenerative changes in the ruptured Achilles tendon (Maffulli et al., 2000a, 2002), and even in the contralateral uninjured tendon, although somewhat less severe than in the injured tendon (Cetti et al., 2003). Thus, it is suggested that these injuries should be classified as a tendinosis that shows itself by rupture (Selvanetti et al., 1997). The degenerative process is not necessarily preceded by pre-injury symptoms, and rupture as an end stage of a degenerative process has also been suggested from repetitive overuse (Jozsa et al., 1989b). The observation that the number of years of competitive badminton is a risk factor supports this view (Kluger et al., 1999). The histopathological picture with microtearing in the tendinosis is associated with increased signal on MRI and hypoechoic regions on ultrasound (Brukner & Khan, 2001). Although

degeneration is found to be more extensive in ruptured Achilles tendons than patients with Achilles tendopathy (Maffulli et al., 2000a), experimental models with repetitive biomechanical loading of the tendon have not been able to induce the same histopathological changes of degeneration in the tendon (Messner et al., 1999; Archambault et al., 2001; Tallon et al., 2001). In the present study, only one-quarter of the patients reported pre-injury symptoms, which is similar to earlier studies on this issue (Kannus & Jozsa, 1991).

A third possibility could be disuse atrophy of the contralateral tendon because of the immobilization of the injured leg. However, whether the rupture risk is due to genetic disposition, degenerative changes, disuse atrophy or other factors cannot be determined by the present study. Nevertheless, as an increasing proportion of the population continues to pursue high-demand sports beyond their 30s and 40s, there is a need for further research to elucidate the risk factors and develop effective prevention strategies for acute Achilles tendon ruptures (Maffulli, 1999). Perhaps one approach to prevent at least contralateral ruptures could be to focus strengthening exercises for the calf muscles on both sides during rehabilitation, not just for the injured leg. It also seems reasonable to advise tendon rupture patients to avoid high-risk sports.

The prevalence of post-injury problems has been reported to range from 5% to 65% in surgically and non-surgically treated patients (Nistor, 1981; Cetti & Christensen, 1983; Cetti et al., 1993; Helgeland, 1997; Speck & Klaue, 1998). The crucial role of the Achilles tendon in walking or running means that slight impairments in function can result in significant functional problems for the patient. In this

study, about half of the patients reported complaints such as pain, reduced strength and decreased range of motion compared with the non-injured side. The use of weight-bearing boots or walkers as a more aggressive rehabilitation seems to reduce the functional impairment in both surgically treated patients and non-operatively treated cases to 5 to 10% of patients (Speck & Klaue, 1998). The best results reported with post-operative casting is 92% return to pre-injury activity level (Soldatis et al., 1997). A rehabilitation program that strengthens the musculotendinous unit in the calf could perhaps not only prevent contralateral injury but also reduce the incidence of post-operative problems. Although the benefit of stretching to prevent injury in healthy individuals has been questioned recently (Herbert & Gabriel, 2002), it may also be worthwhile to include a stretching program in the rehabilitation program.

Perspectives

This study suggests that patients who suffer an acute Achilles tendon rupture have a nearly 200-fold increased risk of a contralateral tendon rupture. It appears reasonable to advise against high-risk activities such as soccer, team handball, squash and badminton until an effective prevention strategy has been developed. This study also shows that at follow-up, about half of the patients treated surgically and with post-operative casting suffer from post-injury problems – pain, decreased strength or reduced range of motion.

Key words: surgical treatment, risk factor, prevention, post-injury problems.

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