DOI: https://doi.org/10.30795/scijfootankle.2018.v12.780

ORIGINAL ARTICLE

Scientific Journal of the Foot & Ankle

Patients with Achilles tendon injuries – how are function and quality of life affected?

Pacientes pós-lesão do tendão calcâneo – como fica a função e a qualidade de vida?

Bruno Mota Albuquerque[1], Vinícius Quadros Borges[1], Gabriel Ferreira Ferraz[1], Kelly Cristina Stéfani[1]

1. Hospital do Servidor Público Estadual, São Paulo, SP, Brazil.

ABSTRACT

Objective: To evaluate the late postoperative results for quality of life after surgical treatment of Achilles tendon rupture by open surgery and peroneus brevis tendon transfer.

Methods: This prospective cohort study included patients who underwent surgical treatment for Achilles tendon rupture by open surgery and peroneus brevis tendon transfer and evaluated these patients in outpatient follow-up. Functional and quality-of-life scores were determined in the late postoperative period.

Results: The sample consisted of 32 patients with spontaneous tendon rupture primarily caused by practising recreational sports (81.1%). The mean age was 44.6 years, and the mean body mass index was 28.1Kg/m^2; most of the patients were men. The rate of complications related to suture dehiscence in the immediate postoperative period was 31%. The World Health Organization Quality of Life-Abbreviated (WHOQOL-BREF) score was 15.2±2.45, the Foot Function Index Revised (FFI-R) score was 42.59±0.16, the Short Musculoskeletal Function Assessment (SMFA) score was 15.60±16.74, and the American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot score was 80.16±15.08.

Conclusion: The late postoperative functional results of open surgical treatment of tendon rupture were satisfactory using the AOFAS score and unsatisfactory using the FFI-R score. The quality-of-life outcomes were satisfactory using the WHOQOL-BREF score and unsatisfactory using the SFMA score. Both the FFI-R and SFMA scores indicated that the main patient complaints were stiffness of the affected limb and pain/discomfort in the tendon that was surgically treated.

Level of Evidence II; Therapeutics Studies; Prospective Study.

Keywords: Achilles tendon/surgery; Quality of life; Rupture.

RESUMO

Objetivo: Avaliar os resultados tardios de função de qualidade de vida do tratamento cirúrgico do tendão calcâneo com reparo aberto e transferência do fibular curto.

Métodos: Neste estudo de coorte prospectivo, foram avaliados, consecutivamente em acompanhamento ambulatorial, pacientes com ruptura do tendão calcâneo tratados cirurgicamente com reparo aberto e transferência do fibular curto. Foram aplicados escores funcionais e de qualidade de vida no pós-operatório tardio.

Resultados: A amostra consistiu em 32 pacientes, todos com mecanismo da lesão espontâneo em prática de atividade esportiva recreativa (81,1%), sendo a maioria homens com média de idade de 44,6 anos e índice de massa corpórea médio de 28,1Kg/m^2. As complicações no pós-operatório imediato relacionadas à deiscência de sutura foram de 31%. O escore WHOQOL foi de 15,2 com desvio padrão (DP) 2,45; o Índice Funcional do Pé Revisado foi de 42,59 com DP 0,16; o escore SMFA foi de 15,60 com DP 16,74; o AOFAS para retropé foi de 80,16 com DP 15,08.

Conclusão: A avaliação pós-operatória tardia do tratamento cirúrgico da ruptura do tendão calcâneo com reparo aberto e transferência do fibular curto apresentou resultados funcionais satisfatórios pelo escore AOFAS e insatisfatórios pelo escore FFI-R.E, apresentou resultados da qualidade

Work performed at the Hospital do Servidor Público Estadual, São Paulo, SP, Brazil.

Correspondence: Kelly Cristina Stéfani. Rua Mato Grosso,306, São Paulo, SP, Brazil – CEP 01239-040. E-mail: kstefani@institutokellystefani.com.br

Conflict of interest: none. **Source of funding:** none.

Date of received: March 15, 2018. **Date accepted:** May 28, 2018. **Online:** June 30, 2018

Copyright © 2018 SciJFootAnkle

de vida satisfatórios pelo escore WHOQOL-bref e insatisfatórios pelo escore SFMA. Tanto o FFI-R quanto o SFMA indicam que a rigidez do membro afetado, seguido pela dor/desconforto no tendão operado, foram as principais queixas de insatisfação do paciente.
Nível de Evidência II; Estudos Terapêuticos, Estudo Prospectivo.

Descritores: Tendão do calcâneo/cirurgia; Qualidade de vida; Ruptura.

How to cite this article: Albuquerque BM, Borges VQ, Ferraz GF, Stéfani KC. Patients with Achilles tendon injuries – how are function and quality of life affected? Sci J Foot Ankle. 2018;12(2):130-5.

INTRODUCTION

The Achilles tendon is the strongest and thickest tendon in the human body, and acute rupture of this tendon is common in young athletes and middle-aged participants in recreational activities[1,2]. Although sport practitioners are usually the most affected, the rate of ruptures in sedentary individuals is 25%[3].

Previous studies have reported that the incidence of Achilles tendon rupture ranges from 7 to 40 per 100,000 people; however, this rate varied depending on the study configuration and the age at the time of rupture[4-8].

The most common site of rupture due to participation in high-demand sports is 3 to 6 cm from the insertion of the Achilles tendon[9,10]. This may be explained by the fact that this portion of the tendon undergoes stress peaks of approximately 70 megapascals (MPa), while other tendons are subjected to forces lower than 30 MPa[11]. Although biomechanical studies have demonstrated the high demands on this tendon, several unknown factors affect tendon degeneration and, consequently, rupture.

The most common intrinsic factors are tendon vascularisation, gastrocnemius-soleus dysfunction, age, gender, body weight, height, pes cavus, and lateral ankle instability. The primary cause of Achilles tendinopathy is a failure to heal properly through irregular proliferation of tenocytes, evidence of degeneration of the tendon cells and rupture of collagen fibres, and a subsequent increase in the non-collagenous matrix. The high rate of matrix remodelling in tendons decreases their mechanical stability and increases their susceptibility to injuries[12].

There is no consensus on the aetiology of Achilles tendon ruptures. However, the predisposing factors identified to date include a reduction in collagen fibres with age[13]; anti-inflammatory responses to corticoid use and continued participation in high-demand sports[14,15]; use of fluoroquinolones[16]; poor blood supply to the Achilles tendon[17]; hyperaemia/increased temperature due to physical activity[18]; and stress combined with supination of the calcaneus and oblique loading on the tendon[19].

A recent systematic review identified biomechanical factors associated with Achilles tendinitis, including a significant decrease in the effect sizes for gait speed, stride length and step length; increased effect sizes for ankle eversion, time to maximum pronation, calcaneal inversion, and ankle and hip joint moments; significant changes in plantar pressures and the timing of ground reaction forces; and differences in the amplitudes and timing of activation of several lower-limb muscles, particularly a decrease in the onset of activity and duration of activation of the gluteus medius[20].

Treatment options have undergone several changes over the last ten years because of the many doubts about the pathophysiology of acute rupture of the Achilles tendon. In our department, routine surgical treatment has been used for many years, and patients with this complication are routinely treated on an outpatient basis.

The objective of this study was to evaluate late postoperative functional and quality of life results following open surgical treatment of Achilles tendon rupture with peroneus brevis tendon transfer.

METHODS

This study was approved by the Ethics Committee with registration in the Brazil Platform under CAAE number: 46540115.1.0000.5463.

Patients with Achilles tendon injuries who were seen by the foot and ankle group were recruited consecutively to participate in this prospective study after signing the informed consent form.

The inclusion criterion was rupture of the Achilles tendon. The exclusion criteria were central neurological diseases (stroke, cerebral palsy, and demyelinating diseases), peripheral neuropathy (diabetes mellitus, leprosy, and alcoholism), use of walking aids, and injuries less than one year old.

The surgical technique used was the following:

- patient in ventral decubitus;

- longitudinal incision medial to the end of the tendon to allow access to the injury site;
- debridement of the proximal and distal stumps of the degenerated tendon;
- suturing using the peroneus brevis tendon as a graft when the spacing between the stumps did not allow for primary suturing of the stumps.

The protocol in the postoperative period was thus:

- nine weeks of immobilisation, including three weeks in maximum equinus, three weeks in equinus, and three weeks in a neutral position with weight-bearing allowed;
- after the immobilisation was completed, rehabilitation was performed by the same physical therapy team with walking training; strengthening of the tibialis anterior, triceps surae, peroneus longus, brevis, and tibialis posterior muscles; and proprioception training. Rehabilitation was performed until a return to daily activities and/or sports was indicated.

The evaluated patient data were gender, age, body mass index (BMI), educational level, smoking, trauma mechanism, early skin complications (suture dehiscence), and time to return to work.

Tendon re-rupture was evaluated in the late postoperative period.

The functional scores applied were the American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot score,[21] which ranges from 0 to 100 (with higher scores indicating better hindfoot function), and the Foot Function Index Revised (FFI-R) score,[22] which ranges from 0 to 100 (with higher scores indicating worse hindfoot function).

The quality of life scores used were the World Health Organization Quality of Life-Abbreviated (WHOQOL-BREF) score, which ranges from 4 to 20 per domain (with higher scores indicating improved overall quality of life),[23] and the Short Musculoskeletal Function Assessment (SMFA) score, which ranges from 0 to 100 (with higher scores indicating worsening of the quality of life associated with musculoskeletal injuries)[24].

The statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS, Inc., Chicago, IL, USA), version 23.0. The means, standard deviations, and maximum and minimum values were used for numerical variables, and descriptive statistics were used for categorical variables.

RESULTS

The sample consisted of 32 patients with spontaneous tendon rupture from participating in the following recreational activities: soccer (53.1%), stretching (18.7%), walking (18.7%), and volleyball (9.3%). The mean BMI was 28.1 kg/m^2.

The mean age at the time of tendon rupture was 44.6 years. The epidemiological profile of the patients is described in Table 1.

Skin complications in the immediate postoperative period occurred in 10 patients (31.3%).

The mean time to return to work was 7.03 months, and the time of return to work in patients with skin complications was 10 months.

Tendon re-rupture occurred in two patients.

The mean AOFAS hindfoot score[21] was 80.16.

The FFI-R score was 42.59, and the scores in its five categories are shown in Table 2.

The WHOQOL-BREF quality of life score was 15.20.

Table 1. Epidemiological profile of patients with ruptured Achilles tendons.

Gender	Frequency	Percentage
Male	20	62.5
Female	12	37.5
Laterality		
Right	13	40.6
Left	19	59.4
Educational level		
Higher	18	56.3
Secondary	12	37.5
Primary	1	3.1
Graduate	1	3.1
History of smoking		
Yes	28	87.5
No	4	12.5

Source: Medical Archive and Statistics Service

Table 2. Foot Function Index Revised Scores.

Category	Minimum	Maximum	Mean	Standard deviation	Variation
Pain	25	89	47.03	0.20332	0.041
Stiffness	25	97	47.22	0.21510	0.046
Difficulty	25	85	44.97	0.18809	0.035
Activities	25	93	40.88	0.17800	0.032
Individual	25	82	37.06	0.15897	0.025
Cumulative	25	84	42.59	0.16386	0.027

Source: Medical Archive and Statistics Service

Table 3. Short Musculoskeletal Function Assessment Scores.

Category	Minimum	Maximum	Mean	Standard deviation	Variation
Activities of daily living	0.00	50.00	11.4063	12.66723	160.459
Emotional state	0.00	60.71	10.8256	15.00195	225.059
Arm and hand function	0.00	90.63	16.2131	20.27490	411.071
Mobility	0.00	58.33	22.9159	16.97700	288.218
Function	0.00	63.97	15.4644	15.12100	228.645
Discomfort	0.00	70.83	16.7969	20.42597	417.220

Source: Medical Archive and Statistics Service

The SMFA score for daily activities was 11.4, and the scores in its six categories are presented in Table 3.

DISCUSSION

Surgical treatment has been the treatment of choice for acute Achilles tendon injuries for the past few decades. This option was initially chosen based on the results of a meta-analysis from 2005[25] that indicated that surgery could reduce the risk of re-rupture compared to non-surgical treatments. However, surgery significantly increased the risk of other complications.

Schönberger et al.[26] surgically treated Achilles tendon ruptures using a traditional method, and the mean time of return to daily activities with it was 3 months. In our sample, the expected time to return to work was 4 months, which is longer than that of the current standards of early rehabilitation treatment. However, the actual mean time to return to work was 7 months, which is almost twice the expected length. This may be related to the rate of complications, as the mean time to return to work in cases with suture dehiscence was 10 months. Therefore, open surgical repair is associated with a significant number of skin lesions in the immediate postoperative period, which is reflected in the patient's delay in returning to work activities.

Delayed returns to work have a significant economic impact given that the epidemiological profile of such patients is that of economically active individuals. In this prospective cohort study, the patients with ruptured Achilles tendons were young adults (mean age of 44.6 years) and non-athletes, and they occasionally participated in recreational sports.

The mean BMI was 28.1 kg/m^2, which is classified as overweight (25-29 kg/m^2) by the World Health Organization, and being overweight is one of the risk factors for Achilles tendon injuries.

The mean WHOQOL-BREF quality of life score of 15.20 (range 4-20) and mean AOFAS functional hindfoot score[21] of 80.16 (range 0-100) were considered satisfactory.

In contrast, although the mean FFI-R score of 42.59 (classified as satisfactory) indicated a good quality of life and foot health, the analysis of the domains with poor scores revealed that the domains with the worst functional outcomes were stiffness of the affected limb (mean of 47.22) and pain in the tendon that was surgically repaired (mean of 47.03).

The SMFA quality of life score, which evaluates the quality of life related to musculoskeletal injuries, was worse for the domains of mobility (mean of 22.91) and discomfort (mean of 16.79).

The combined results of the SFMA and FFI-R scores indicated that the most common complaints in the late postoperative period were stiffness of the affected limbs and pain/discomfort in the operated tendons. These complaints may be associated with our 9-week prolonged immobilisation rehabilitation protocol.

Several studies have evaluated postoperative management in both surgical and conservative treatments for Achilles tendon rupture, and although there was no consensus on the best approach, systematic reviews indicated that both early mobilisation and early weight bearing are associated with earlier returns to pre-injury activities, significant increases in calf muscle strength, less atrophy, and tendon elongation[27,28].

Recent randomised studies[29-31] support the finding that non-surgical treatment combined with early weight bearing and controlled movement rather than immobilisation has results similar to those of surgical treatment in terms of the rupture rate while avoiding the risks of surgical complications.

A recent systematic review[32] evaluated 375 patients who underwent open surgery and reported that the rate of complications was 14.1%, in contrast to the 31% in our sample. These postoperative complications can be avoided by using non-surgical treatment; functional results are similar to those with surgical treatment. However, the present study did not include a randomised controlled trial that allowed for a comparison of these two types of treatment.

CONCLUSION

A late postoperative evaluation of open surgical treatment for Achilles tendon rupture with peroneus brevis tendon transfer revealed satisfactory functional results according to the AOFAS score but unsatisfactory results according to the FFI-R score. The quality-of-life results were satisfactory using the WHOQOL-BREF score but unsatisfactory using the SFMA score.

Both the FFI-R and SFMA scores indicated that the most common complaints were stiffness of the affected limb and pain/discomfort in the tendon that was surgically repaired.

Authors' contributions: Each author contributed individually and significantly to the development of this article: BMA *(http://orcid.org/0000-0001-9714-4235) wrote the article and interpreted the results of the study; VQB *(http://orcid.org/0000-0001-7889-890) performed a bibliographic review and participated in the review process; GFF *(http://orcid.org/0000-0001-8032-3077) interpreted the results of the study and participated in the review process; KCS *(http://orcid.org/0000-0003-1534-9654) conceived and planned the activities that led to the study, participated in the review process and approved the final version. *ORCID (Open Researcher and Contributor ID).

REFERENCES

1. Moller A, Astron M, Westlin N. Increasing incidence of Achilles tendon rupture. Acta Orthop Scand. 1996;67(5):479-81.
2. Movin T, Ryberg A, McBride DJ, Maffulli N. Acute rupture of the Achilles tendon. Foot Ankle Clin. 2005;10(2):331-56.
3. Winter E, Weise K, Weller S, Ambacher T. Surgical repair of Achilles tendon rupture. Comparison of surgical with conservative treatment. Arch Orthop Trauma Surg. 1998;117(6-7):364-7.
4. Nyyssonen T, Luthje P, Kroger H. The increasing incidence and difference in sex distribution of Achilles tendon rupture in Finland in 1987-1999. Scand J Surg. 2008;97(3):272-5.
5. Houshian S, Tscherning T, Riegels-Nielsen P. The epidemiology of Achilles tendon rupture in a Danish county. Injury. 1998;29(9):651-4.
6. Levi N. The incidence of Achilles tendon rupture in Copenhagen. Injury. 1997;28(4):311-3.
7. Leppilahti J, Puranen J, Orava S. Incidence of Achilles tendon rupture. Acta Orthop Scand. 1996;67(3):277-9.
8. Nillius SA, Nilsson BE, Westlin NE. The incidence of Achilles tendon rupture. Acta Orthop Scand. 1976;47(1):118-21.
9. Flik KR, Bush-Joseph CA, Bach BR, Jr. Complete rupture of large tendons: risk factors, signs, and definitive treatment. Phys Sportsmed. 2005;33(8):19-28.
10. Kannus P, Jozsa L. Histopathological changes preceding spontaneous rupture of a tendon. A controlled study of 891 patients. J Bone Joint Surg Am. 1991;73(10):1507-25.
11. Komi PV, Fukashiro S, Jarvinen M. Biomechanical loading of Achilles tendon during normal locomotion. Clin Sports Med. 1992;11(3):521-31.
12. Longo UG, Ronga M, Maffulli N. Achilles Tendinopathy. Sports Med Arthrosc Rev. 2018;26(1):16-30.
13. Strocchi R, De Pasquale V, Guizzardi S, Govoni P, Facchini A, Raspanti M, et al. Human Achilles tendon: morphological and morphometric variations as a function of age. Foot Ankle. 1991;12(2):100-4.
14. Beskin JL, Sanders RA, Hunter SC, Hughston JC. Surgical repair of Achilles tendon ruptures. Am J Sports Med. 1987;15(1):1-8.
15. Gill SS, Gelbke MK, Mattson SL, Anderson MW, Hurwitz SR. Fluoroscopically guided low-volume peritendinous corticosteroid injection for Achilles tendinopathy. A safety study. J Bone Joint Surg Am. 2004;86(4):802-6.
16. Wise BL, Peloquin C, Choi H, Lane NE, Zhang Y. Impact of age, sex, obesity, and steroid use on quinolone-associated tendon disorders. Am J Med. 2012;125(12):1228.e23-.e28.
17. Ahmed IM, Lagopoulos M, McConnell P, Soames RW, Sefton GK. Blood supply of the Achilles tendon. J Orthop Res. 1998;16(5):591-6.
18. Wilson AM, Goodship AE. Exercise-induced hyperthermia as a possible mechanism for tendon degeneration. J Biomech. 1994;27(7):899-905.
19. Barfred T. Experimental rupture of the Achilles tendon. Comparison of various types of experimental rupture in rats. Acta Orthop Scand. 1971;42(6):528-43.
20. Ogbonmwan I, Kumar BD, Paton B. New lower-limb gait biomechanical characteristics in individuals with Achilles tendinopathy: A systematic review update. Gait Posture. 2018;62:146-56.
21. Kitaoka HB, Alexander IJ, Adelaar RS, Nunley JA, Myerson MS, Sanders M. Clinical rating systems for the ankle-hindfoot, midfoot, hallux, and lesser toes. Foot Ankle Int. 1994;15(7):349-53.
22. Stefani KC, Pereira MVF, Oliveira PR, Wun PYL. Translation, cultural adaptation and validation of the foot function index - revised (FFI-R). Acta Ortop Bras. 2017;25(5):188-93.
23. Fleck MP, Louzada S, Xavier M, Chachamovich E, Vieira G, Santos L, et al. Application of the portuguese version of the abbreviated instrument of quality life WHOQOL-bref. Rev Saude Publica. 2000;34(2):178-83.
24. Taylor MK, Pietrobon R, Menezes A, Olson SA, Pan D, Bathia N, et al. Cross-cultural adaptation and validation of the Brazilian Portuguese version of the short musculoskeletal function assessment questionnaire: the SMFA-BR. J Bone Joint Surg Am. 2005;87(4):788-94.
25. Khan RJ, Fick D, Keogh A, Crawford J, Brammar T, Parker M. Treatment of acute Achilles tendon ruptures. A meta-analysis of randomized, controlled trials. J Bone Joint Surg Am. 2005;87(10):2202-10.
26. Schonberger TJ, Janzing HM, Morrenhof JW, de Visser AC, Muitjens P. Operative treatment of acute Achilles tendon rupture: Open end-to-end-reconstruction versus reconstruction with Mitek-anchors. Acta Chir Belg. 2008;108(2):236-9.

27. Brumann M, Baumbach SF, Mutschler W, Polzer H. Accelerated rehabilitation following Achilles tendon repair after acute rupture - Development of an evidence-based treatment protocol. Injury. 2014; 45(11):1782-90.

28. Huang J, Wang C, Ma X, Wang X, Zhang C, Chen L. Rehabilitation regimen after surgical treatment of acute Achilles tendon ruptures: a systematic review with meta-analysis. Am J Sports Med. 2015; 43(4):1008-16.

29. Nilsson-Helander K, Silbernagel KG, Thomee R, Faxen E, Olsson N, Eriksson BI, et al. Acute achilles tendon rupture: a randomized, controlled study comparing surgical and nonsurgical treatments using validated outcome measures. Am J Sports Med. 2010;38(11): 2186-93.

30. Wallace RG, Heyes GJ, Michael AL. The non-operative functional management of patients with a rupture of the tendo Achillis leads to low rates of re-rupture. J Bone Joint Surg Br. 2011;93(10):1362-6.

31. Willits K, Amendola A, Bryant D, Mohtadi NG, Giffin JR, Fowler P, et al. Operative versus nonoperative treatment of acute Achilles tendon ruptures: a multicenter randomized trial using accelerated functional rehabilitation. J Bone Joint Surg Am. 2010;92(17):2767-75.

32. Del Buono A, Volpin A, Maffulli N. Minimally invasive versus open surgery for acute Achilles tendon rupture: a systematic review. Br Med Bull. 2014;109:45-54.