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Risk factors for achilles tendon rupture: A matched case control study

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ABSTRACT

Purpose: The purpose of this study was to elucidate whether body mass index (BMI), activity level, and other risk factors predispose patients to Achilles tendon ruptures.
Materials and methods: A retrospective review of 279 subjects was performed (93 with Achilles tendon rupture, matched 1:2 with 186 age/sex matched controls with ankle sprains). Demographic variables and risk factors for rupture were tabulated and compared.
Results: The rupture group mean BMI was 27.77 (95% CI, 26.94–28.49), and the control group mean BMI was 26.66 (95% CI, 26.06–27.27). These populations were found to be statistically equivalent ($p = 0.047$ and $p < 0.001$ by two one-sided t-test). A significantly higher proportion of those suffering ruptures reported regular athletic activity at baseline (74%) versus controls (59%, $p = 0.013$).
Conclusion: There was no clinically significant difference found in BMI between patients with ruptures and controls. Furthermore, it was found that patients who sustained ruptures were also more likely to be active at baseline than their ankle sprain counterparts.

Introduction

Achilles tendon ruptures often take place during sporting activity and can lead to significant morbidity. The incidence of these ruptures is reported to be between 6 and 37 cases per 100,000 person-years, and the incidence appears to be increasing over recent decades [1–7]. Conservative and operative treatments exist for patients suffering Achilles tendon ruptures; either way, these patients have a long recovery and may not return to their preinjury level of sporting activity. An improved understanding of the risk factors that can predispose a person to suffer an Achilles tendon rupture, as opposed to a more common injury such as an ankle sprain, may help better guide the prevention, diagnosis, and treatment of these injuries.

Prior studies have identified a number of risk factors correlated with the incidence of Achilles tendon ruptures, some of which include age, gender, body mass index (BMI), race, smoking status, fluoroquinolone use, local and oral corticosteroid use, history of prior Achilles tendinopathy, blood type, diabetes and other medical comorbidities, and participation in sports [8–12]. These studies have largely been performed in countries other than the United States, or in United States military populations, with only a few recent studies examining the incidence of Achilles ruptures in the general U.S. civilian population.

A common conclusion in some prior studies is that patients with a sedentary lifestyle and a high BMI have an increased risk of sustaining an Achilles tendon rupture, possibly due to poor circulation and subsequent hypoxic degeneration of the Achilles tendon [13–17]. However, in our clinical practice we have observed that ruptures in healthy, active patients occur with greater regularity than in overweight, sedentary persons. Achilles tendon ruptures are thought to be the end-product of a degenerative tendon that is subjected to an eccentric force of sufficient magnitude to rupture the tendon [18,19]. An individual's BMI is not likely to play much of a role in either of these factors, with the possible exception that those with a high BMI may be less likely to engage in activities that would achieve a sufficiently large eccentric force to cause a rupture. We thus hypothesize that being sedentary is in fact a protective factor, as inactive people rarely experience the stresses on the Achilles tendon necessary to produce a rupture. In contrast with the thinking of some prior studies that a high BMI is a clinically significant risk factor for Achilles tendon ruptures, we hypothesize that there is no clinically significant difference in the mean BMI of patients who suffer ruptures and that of a general population of patients suffering ankle sprains.

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This case-control study thus sought to examine a series of patients in a general US population diagnosed with a primary Achilles tendon rupture and to determine which patient-related factors may predispose patients to a rupture as compared to age and sex matched controls who suffer ankle sprains after a similar mechanism of injury.

Materials and methods

Patients

Institutional review board approval was obtained before retrospective review was performed on charts of all patients presenting with the International Classification of Disease-9th Edition (ICD-9) code for Achilles tendon rupture (727.67) during a 5-year period between January 2010 and December 2014. The diagnosis of Achilles tendon rupture or ankle sprain was confirmed by chart review, and demographic information was obtained from clinical charts, registration information, and operative reports when applicable. For those patients who underwent surgical treatment, rupture was confirmed by an indicated visualization in the operative report. For the control group, the same procedure was repeated for all patients with an ICD-9 code representing ankle sprain (845.00). The confirmation of the individual clinical diagnoses were ultimately made based on clinical exam: Achilles tendon rupture based on altered resting tension relative to the other uninjured side and Thompson test; ankle sprain based on a history of inversion injury, negative radiographs, and tenderness to palpation over the anterior talofibular ligament and/or calcaneofibular ligament.

All patients aged 18–70 who had clinical data confirming their respective primary diagnoses were included. Patients were excluded if there was insufficient data to calculate body mass index (BMI), had bilateral ruptures, or presented more than 12 weeks after injury which precluded the calculation of an accurate BMI at time of injury. Patients were also excluded if their injury was not an acute rupture or re-rupture after a prior operative intervention. Both cases and controls were excluded if radiographs and/or clinical evaluation suggested an alternative primary diagnosis (e.g. ankle fracture).

Study design

In this 2-to-1 matched cohort study, each subject with an Achilles tendon rupture was randomly paired by computer software with two age and sex matched controls that presented with ankle sprains. A control group was utilized to increase the statistical weight of the study in a way that could not be gained through a simple case series. Ankle sprains were chosen as a control group due to the frequency with which physicians in our practice see these patients as the patient's first line of treatment, thus making them a readily identifiable set of patients seen by the physicians participating in this study. Moreover, ankle sprains occur in every demographic of the population and were therefore thought to be a reasonable proxy for the general population. The maximum age difference between subject and control that was allowed during matching was one year.

Information about each patient's treatment course and demographics was recorded, including variables which have historically been demonstrated to affect the risk of rupture: age, gender, BMI, race, occupation, tobacco use, baseline participation in athletic activities (reported as a "yes or no" question on patient intake form), mechanism of injury, medical comorbidities, history of Achilles tendinopathy, history of fluoroquinolone use, and history of exposure to local or systemic corticosteroids. Mechanism of injury was not recorded for the control group as these patients were used as a proxy for the general population. The presence of clinical obesity was assessed per World Health Organization guidelines, with subjects having a BMI of 30 or above being classified as obese, and below 30 as non-obese [20].

Table 1
Achilles Tendon Rupture and Ankle Sprain (Control) Group Demographics.

	Achilles Tendon Rupture		Control (Ankle Sprain)		
Demographic Variable	n	% of Total	n	% of Total	*p*
Sex					1.000
Female	11	12%	22	12%	
Male	82	88%	164	88%	
Age at Injury					1.000
18–29	19	20%	38	20%	
30–39	33	35%	66	35%	
40–49	21	23%	42	23%	
50–59	9	10%	18	10%	
60–69	11	12%	22	12%	
Race					0.058
Asian	4	4%	13	7%	
Black	13	14%	9	5%	
Hispanic	15	16%	25	13%	
White Non-Hispanic	34	37%	87	47%	
Refused to Self-Identify/Other	27	29%	52	28%	
Side					0.018*
Left	57	61%	86	46%	
Right	36	39%	100	54%	
Treated Operatively					<0.001*
Yes	77	83%	1	1%	
No	16	17%	182	98%	

p = p-value obtained by using chi-squared test.
* $p < 0.05$.

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