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Increasing age in Achilles rupture patients over time

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ABSTRACT

Background: The changing demographics of Achilles tendon rupture (ATR) patients have not fully been investigated. However, there has been a general suspicion that this injury is occurring in an increasingly older population, in terms of mean age. The aim of this study was to objectively show an increase in age in Achilles tendon rupture patients over time.

Methods: Published literature on Achilles tendon ruptures was searched for descriptive statistics on the demographics of patients in the studies, specifically mean and median age of Achilles tendon rupture patients, gender ratio, percentage of athletics-related injuries, percentage of smokers, and BMI. Linear regression analyses were performed to determine the trend of patient demographics over time. A Welch one-way ANOVA was carried out to identify any possible differences in data obtained from different types of studies.

Results: The patient demographics from 142 studies were recorded, with all ATR injuries occurring between the years 1953 and 2014. There was no significant difference in the mean age data reported by varying study types, i.e. randomized controlled trial, cohort study, case series, etc. ($P = 0.182$). There was a statistically significant rise in mean age of ATR patients over time ($P < 0.0005$). There was also a statistically significant drop in percentage of male ATR patients ($P = 0.02$). There is no significant trend for percentage of athletics-related injuries, smoking or BMI.

Conclusion: Since 1953 to present day, the mean age at which ATR occurs has been increasing by at least 0.721 years every five years. In the same time period, the percentage of female study patients with ATR injuries has also been increasing by at least 0.6% every five years.

Level of evidence: Level III; Retrospective cohort study

Introduction

Achilles tendon ruptures are the most common tendon rupture in the human body [1,2], accounting for approximately 20%–35% of all large tendon injuries [3–6]. As reported in the literature, the incidence of ATRs has been increasing over the past few decades [1,7–11]. There is certainly a wide range of factors contributing to this trend, including increased participation in athletics [10,12] and a more active older population [1,4].

The exact mechanism of an ATR is not known. Most ATRs occur with athletic activity involving eccentric contraction of the gastrocnemius-soleus complex [4]. However, these injuries can also occur because of an inadvertent misstep with lower level activity such as walking. Generally, ATRs require preexisting areas of degeneration or tendinopathy acting as a focal weak point in the Achilles tendon (AT) before the actual rupture [13,14]. Full recovery from an ATR for most patients often takes between 6 and 12 months [15].

Men generally experience ATRs at a much higher rate than women. Vosseller et al. suggested that the male: female ratio of ATR injuries was 5.39:1 [14]; other studies have variations in this ratio with a range from 2:1 to 12:1 [16]. Moreover, ATRs are more common in athletes, especially those who participate in sports that require rapid changes in direction, such as tennis and basketball [15].

The published literature on ATRs is well-established. The studies are diverse in type and methodology. Many studies examine clinical outcomes of operative versus nonoperative treatment. There are also many epidemiological studies reporting the demographics of patients who suffer ATRs in their respective patient populations. These studies are mostly from European nations (such as Denmark and Sweden) that support large national registries or databases for documenting patient health.

To our knowledge, however, no attempt has ever been made to compose a descriptive review that analyses how the demographics of patients suffering ATRs have changed over time. The hypothesis

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of this study was that mean age at the time of rupture has been increasing over the past few decades, since ATR studies first began documenting patient demographics. A secondary goal of this study was to identify any other trends in demographic information that might exist over time, such as the gender ratio of study patient population, percentage of athletics-related ruptures, percentage of smokers, and BMI.

Materials and methods

Literature search

The authors utilized several online medical databases, including PubMed, MEDLINE, and the Cochrane Central Registry of Controlled Trials. For PubMed and Cochrane, the search strategy targeted the terms "Achilles tendon rupture," and "Achilles rupture incidence." In MEDLINE, the following search strategy was used: "Achilles Tendon"[MeSH] AND "Rupture"[MeSH] AND "Randomized Controlled Trials as Topic"[MeSH] OR "Cohort Studies"[MeSH] OR "Retrospective Studies"[MeSH], limited to the English language and human study subjects. Clinical trials, cohort studies, and retrospective studies were targeted because they were more likely to report patient demographics. The references of these studies were also reviewed to identify further potential studies to include. All studies that provided demographic data were included in our analysis [17–147].

Data extraction

The full texts of each study were accessed, and the descriptive statistics therein, if available, were recorded: primary author, year of publication, time period during which ATR occurred for the patients in the study, country in which study was performed, study type (clinical trial, case series, cohort, comparative, descriptive epidemiology, etc.), sample size, gender ratio, mean age of patients at the time of ATR, median age of patients at the time of ATR, age range, percentage of injury due to athletic activity, percentage of smokers in the study, and BMI. These categories were recorded because they were the most commonly reported descriptive statistics in published studies. All data was organized and recorded in *Excel* (Microsoft Corporation, Redmond, WA, USA).

The independent variable for the data was time, grouped into units of five-year intervals. The following intervals were used: before 1970, 1970–1974, 1975–1979 . . . 2005–2009, 2010-present. This grouping was chosen for convenience. Many studies reported a year range of ATR injuries that crossed over these intervals. For example, Fox et al. included data on ATRs from 1968 to 1973, a range that spans two of our predetermined five-year intervals. To account for these types of year ranges, the data from such entries were weighted by the number of years within each five-year period and then distributed amongst the different intervals accordingly. A similar series of calculations was then performed that factored in each study's sample size (N), such that data from studies with larger N's were weighted more. This modified set of data, referred to as the all-inclusive group, was then analyzed.

Certain studies were then removed from the all-inclusive data to create a new dataset, termed the sub-group data. First, all publications based on data from national health registries or large healthcare databases were excluded because they can sometimes be unreliable and inaccurate [148,149]. These databases are also a relatively new tool used for tracking large-scale patient health dynamics and might skew the results due to the large sample sizes of databases. Next, studies with specific patient populations, such as the elderly, diabetics, etc., were removed because they do not sample a heterogeneous patient population. Finally, studies that examined re-ruptures or neglected tears were excluded; only studies on acute ATRs were included. This sub-group dataset was then also analyzed. The sub-group data was created to see whether or not results would remain the same when possible sources of confounding biases were removed (Fig. 1).

Statistical analysis

The data was first analyzed by calculating the means of six descriptive statistics within each five-year interval, in both the all-inclusive and the sub-group datasets. These categories include mean age, median age, gender ratio, percentage of athletics-related injuries, percentage of patients that smoke, and BMI. Linear regression was utilized to examine the trend of mean age, median age, percentage of male patients, percentage of athletics-related injuries, percentage of patients that smoke, and BMI over time. The *R-Squared* and *P values* were obtained. A one-way Welch analysis of variance (ANOVA) was conducted to determine if there was a difference in the reported mean age by different study types included in this review. All statistical analyses were performed using *SPSS Statistics Version 22.0* (IBM, Chicago, IL, USA). Statistical significance was set as $P\ value < 0.05$.

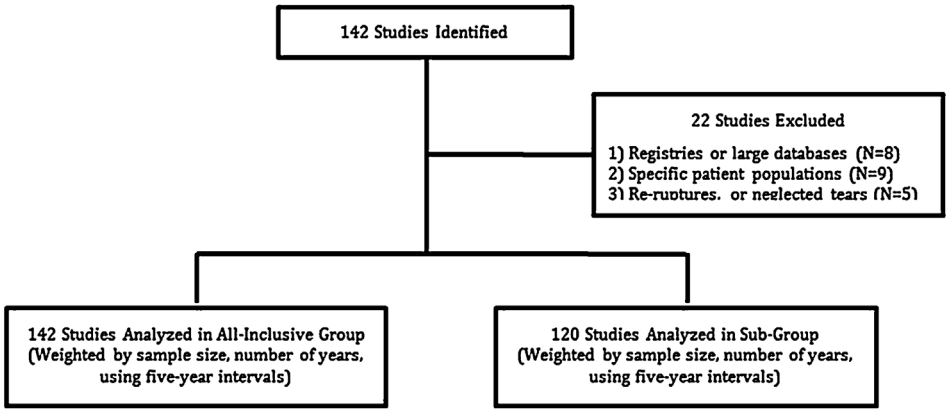

Fig. 1. Flow diagram for study design.