Epidemiologic Factors Associated with Rupture of the Achilles Tendon

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ABSTRACT

In a retrospective, multicenter study, the medical records of 58 patients (39 males, 19 females) with spontaneous rupture of the Achilles tendon were examined. The average age was 41 years. Twenty-two percent were hypertensive, 19% were obese, and 10% had diabetes mellitus. Nine patients (16%) had been treated with either local steroid injections or oral corticosteroids and two patients had rheumatoid arthritis (3%). Of the patients who were 50 years of age and over, 53% were hypertensive, 35% were obese, 24% had taken steroids, and 23% were diabetic. Chi-square analysis indicated a statistically increased incidence of these degenerative factors in the older population. In spite of the relatively small number of patients in this series, this information suggests that degenerative factors may be strongly associated with Achilles tendon ruptures in middle-aged and older patients.

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INTRODUCTION

Achilles tendon ruptures are a relatively infrequent occurrence.[1,2] Numerous descriptions of the diagnostic signs of Achilles rupture have been reported in the orthopaedic literature,[3,4] and various modalities of treatment have been proposed for both operative and nonoperative management.[5-13] Little has been reported concerning the underlying factors that may contribute to these tendon ruptures. In light of the generally held assertion that these injuries preferentially occur in otherwise active middle-aged men, a clearer appreciation of these factors seems important.[3,14]

This study is a retrospective review of patients with known ruptures of the Achilles tendon. The specific goals were to identify and enumerate epidemiologic factors associated with Achilles tendon ruptures. These factors are discussed in light of the current knowledge of the anatomy, biochemistry, and pathophysiology of Achilles tendon ruptures.

METHODS

The medical records of 58 patients from the University of California, Davis, the private practice of Roger A. Mann, M.D., Highland Hospital in Oakland, and Thomas Jefferson University in

Philadelphia were available for review. All patients were treated by either immobilization or surgical repair. The diagnosis and treatment plan were formulated by the orthopaedists at the various institutions. A complete medical history was obtained for each patient, including specific information concerning concurrent and prior medical illnesses and previous surgery. A specific assessment of the patients' height and weight also was obtained from the medical records. In the event that a portion of the medical record was incomplete, the patient was contacted by telephone. For each of the 58 patients in this study there was was a completed record which included: 1) name, 2) age, 3) sex, 4) description of the circumstances of the injury, and 5) medical history (hypertension, diabetes mellitus, obesity, steroid injections, oral corticosteroids, and other medical problems).

Criteria were established for classification within certain medical categories. Patients with hypertension had been diagnosed as such by their internist or family physician and were involved in an active treatment plan of diet, weight-control, and/or medication. The information concerning use of corticosteroids included either a history of local injections about the Achilles tendon or oral corticosteroids for psoriatic arthritis, sarcoidosis, or chronic bronchitis. The usual indication for injection was presumed Achilles tendinitis or peritendinitis. Patients were categorized as obese according to the criteria of Craddock.[15] Obesity was defined as an excess of adipose tissue along with a weight of more than 20% above the normal or predicted weight for a specific age and height. The diagnosis of diabetes had been made according to criteria chosen by the treating internist or family physician. Therefore, standard diagnostic criteria could not be used for assignment to the diabetic group. All patients with diabetes mellitus (Type I or II) were being treated by diet control, hypoglycemic agents, or insulin.

Statistical analysis was performed on the data obtained from this retrospective review. Analysis was primarily directed toward an assessment of the association of various medical histories with ruptures of the Achilles tendon. This was accomplished by Chi-square analysis. Patients were assessed both in total and by age, either under or over 50 years of age. The factors of hypertension, diabetes mellitus, obesity, and steroid use were assessed individually and as a group.

RESULTS

The medical records of 58 patients with a diagnosis of rupture of the Achilles tendon were available for review. These patients included 39 males (67%) and 19 females (33%) whose average age was 41 years. Overall, 22% were hypertensive, 19% were obese, 16% had a history of either local steroid injections or oral corticosteroids, and 10% had diabetes mellitus. Only two patients in this series had rheumatoid arthritis.

The diagnoses of hypertension, obesity, and diabetes were then analyzed on the basis of age. Patients were grouped in one of two age groups: 1) 20 to 50 years of age, and 2) 51 years and older. The frequency of these age-related disorders was considerably greater in the older patients than in the younger patients.

Chi-square analysis was performed comparing the prevalence of hypertension, obesity, diabetes, and steroid use between the two age groups and the total group. There was a significant correlation between Achilles ruptures and hypertension ($p < .005$). When the factors of hypertension, obesity, and diabetes mellitus are taken together, there was a significant association between these disorders and the presence of rupture of the Achilles tendon ($p < .005$).

DISCUSSION

The purpose of this study was to highlight epidemiologic factors that may be associated with ruptures of the Achilles tendon. Optimally, it would be best to identify an array of epidemiologic factors in a population of patients with rupture of the Achilles tendon and statistically compare these factors in an age-matched control population. The relatively small number of patients with Achilles tendon ruptures in this as in other series makes such a rigorous analysis difficult, at best. Therefore, the approach and goals of this study were, by definition, more limited in scope. Specifically, the data gathered provide for a qualitative analysis of the

TABLE I

Prevalence of Age-related Disorders

		Normal	Diabetes	Obesity	Steroid Use	Rheumatoid Arthritis	Hypertension
Total	(58)	27 (46%)	06 (10%)	11 (19%)	09 (16%)	02 (3%)	13 (22%)
<50	(41)	25 (60%)	02 (4%)	05 (12%)	05 (12%)	01 (2%)	04 (10%)
>50	(17)	02 (12%)	04 (23%)	06 (35%)	04 (24%)	01 (6%)	09 (53%)

relationship of certain factors to rupture of the Achilles tendon. Based on certain assumptions, some statistical insight is also possible. An integration of both this qualitative and quantitative analysis with the current biochemical and anatomic data leads to some basic conclusions concerning possible epidemiologic associations with ruptures of the Achilles tendon.

A qualitative inspection of the data indicates that, as previously described by numerous authors, ruptures of the Achilles tendon occur most frequently in middle-aged men. Previous studies that dealt primarily with issues of diagnosis and treatment failed to thoroughly document any associated medical disorders. In descending order, the secondary diagnoses were hypertension, obesity, exposure to corticosteroids, and diabetes mellitus.

Even on a qualitative basis, to be meaningful these data require interpretation in the context of the prevalence of these disorders in the population-at-large. Hypertension, obesity, and diabetes are age-related diseases, that is, their prevalence increases with advancing age. Therefore, the prevalence of these factors was analyzed with respect to both the group in its entirety and the subsets of patients above and below the age of 50.

An estimation of the prevalence of hypertension, obesity, and diabetes mellitus in the population-at-large in the United States was made based on an examination of various data sources (Table I).[15-19] Hypertension and diabetes are individually more prevalent in patients more than 50 years of age with Achilles tendon ruptures than in the general population for the same age. A qualitative inspection of the percentages of hypertension, obesity, and diabetes for patients with rupture of the Achilles tendon does not show a demonstrable difference from what is seen in the younger popula-

Another way to approach the data is to assess the frequency of ruptures that actually occur in patients without hypertension, diabetes mellitus, obesity, and exposure to steroids. Only three of 17 patients in this series who are more than 50 years of age are nondiabetic, nonobese, nonhypertensive, and without exposure to steroids. The validity of this approach is based upon the linkage of these disorders. The epidemiologic interrelationship of hypertension, diabetes, and obesity has been documented by several authors. Obese patients are at greater risk for the development of diabetes than nonobese patients.[17] Obese and diabetic patients also are more likely to be hypertensive than nonobese and nondiabetic patients.[19-21] Atherosclerotic disease of both large and small vessels is common to both hypertension and diabetes.[20,21] Finally, evidence suggests that hypertension may increase the relative risk of developing diabetes.[22] The interrelationship between hypertension, diabetes, and obesity is undisputable, albeit complex in nature. With this in mind, 35% of the total number of patients in this study had one of these disorders, while 64% of patients over the age of 50 years had one or more of these disorders.

The role of steroids is on the microvascular level. The complication of avascular necrosis has been well documented in the orthopaedic literature. Injections and oral corticosteroids have been implicated by many authors in ruptures of the Achilles

cated by many authors in ruptures of the Achilles tendon.[23-26] Other authors have reported avascular changes in tendons repaired and then exposed to local corticosteroids. Therefore, steroids have been demonstrated to have a detrimental effect on the intrinsic and small vessel vascularity of tendons.

The epidemiologic data can be intepretated with respect to our knowledge of the basic biology and anatomy of ruptures of the Achilles. Some data have been forthcoming that contribute to our knowledge of the pathologic processes that may contribute to Achilles ruptures. Naito has shown through labelled hydrogen wash-out studies that there is a hypovascular zone in the middle third of the Achilles tendon.[27] This has been postulated to occur in the portion of the tendon most commonly involved in ruptures. Injection studies further support this assertion.[28] Coombs has demonstrated a higher percentage of type III collagen in patients with a ruptured Achilles.[29]

Microvascular, anatomic dissection, injection, and hydrogen wash-out studies clearly implicate a diminution of local vascularity in Achilles tendon ruptures. Evidence suggests that obesity, hypertension, diabetes, and even steroids may in some manner diminish small vessel vascularity.

CONCLUSION

A qualitative and limited quantitative analysis suggests that the degenerative processes of aging, diabetes, hypertension, obesity, and treatment with corticosteroids are epidemiologic factors that may be associated with rupture of the Achilles tendon. At a minimum, this initial survey should encourage orthopaedic surgeons to look more closely at the associated medical illnesses of patients with ruptures of the Achilles tendon.

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