EJR European Journal of Rheumatology

DOI: 10.5152/eujrheum.2022.21132

Original Article

Sonoelastrographic finding of Achilles tendon in patients with ankylosing spondylitis and acromegaly

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Abstract

Objectives: Achilles tendinopathy can be noticed in both acromegaly and ankylosing spondylitis (AS). Acromegaly patients presenting with tendinopathy findings may be confused with AS findings. In this study, sonoelastrographic findings of Achilles tendon are explored in patients with AS and acromegaly.

Methods: 25 patients with AS, 30 patients with acromegaly, and 18 healthy controls were enrolled in the study. Achilles tendon was evaluated by sonoelastography in all the study participants.

Results: The thickness of Achilles tendon in neutral positions was higher in acromegaly patients than those in AS patients. The sonoelastography measurement of Achilles tendon was increased in acromegaly patients when compared to the control group and AS patients.

Conclusion: The thickness of Achilles tendon can increase in patients with acromegaly and AS. However, the sonoelastographic features of Achilles tendon can be similar in patients with AS and acromegaly.

Keywords: Acromegaly, ankylosing spondylitis, sonoelastography

Introduction

Spondyloarthritis (SpA) is composed of a group of heterogeneous diseases. Ankylosing spondylitis (AS) is the prototype of this group. AS is primarily involved in axial involvement. However, it may lead to peripheral involvement in approximately 30% of patients. Tendinitis and enthesitis can be seen in these patients due to inflammation in the tendon sheath and the regions in which tendons attach to the bone.[1]

Acromegaly is a disease characterized by the pathological level release of growth hormone (GH). Different musculoskeletal involvements such as peripheral joint pain, back pain, and functional impairment in joints can be observed in these patients.[2,3] Also, there can also be a complaint of low back pain in acromegaly patients. Moreover, the pain complaints of these patients can be both mechanical and inflammatory. Acromegaly may mimic AS clinically and radiologically with axial and peripheral joint involvement.[4]

Achilles tendinitis is often associated with recurrent trauma and intense pressure exposure in individuals who frequently exercise intensely.[5] Although the detection of Achilles tendinitis supports the diagnosis of SpA, other causes of this condition need to be ruled out. Achilles tendinopathy can be seen in both acromegaly and AS patients. Furthermore, acromegaly patients presenting with joint and tendinopathy findings may be confused with SpA findings.

Ultrasonography (US) is frequently used to evaluate Achilles tendinitis. Sonoelastography is an US technique used to detect the stiffness of the tissue. It has advantages such as low cost, easy accessibility, and radiation-free. It is used to evaluate tissue in breast, thyroid, and liver diseases.[6,7] It has been used in recent years to identify changes in stiffness and elasticity of muscles-tendons and is more sensitive than B-mode US.[8]

Here, we aimed to determine and compare the sonoelastographic findings of Achilles tendon in patients with AS and acromegaly.

Methods

Patients and controls

Twenty-five AS patients diagnosed according to the criteria of the Assessment of Spondyloarthritis International Society (ASAS),[9] 30 acromegaly patients diagnosed according to the level of serum IGF-1

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Cite this article as: Karataş A, Artaş H, Uğur K, Koca SS. Sonoelastrographic finding of Achilles tendon in patients with ankylosing spondylitis and acromegaly. *Eur J Rheumatol.* 2022;9(3):122-125.

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Submitted: June 22, 2021
Accepted: September 27, 2021
Available Online Date: February 7, 2022

Table 1. Clinical and radiological data of the groups.

	HC (n = 18)	Acromegaly (n = 30)	AS (n = 25)
Age (years)	38 ± 8.11	40.81 ± 8.86	37.15 ± 9.59
Achilles tendon thickness (mm)	4.25 ± 0.58	4.86 ± 0.54*	4.51 ± 0.41†
Achilles tendons sonoelastography	0.50 ± 0.26	0.62 ± 0.27‡	0.55 ± 0.29

HC, healthy controls; AS, ankylosing spondylitis; mm, millimeter.
When compared to the HC.
*$P < .01$.
‡$P < .05$.
When compared to the acromegaly.
†$P < .05$.

(insulin-like growth factor) and increased GH level observed after oral glucose tolerance test (OGTT) with 75 g glucose,[10] and 18 healthy controls were included in our study. Patients receiving fluoroquinolone and glucocorticoid therapy for the last 3 months and those with a known history of traumatic injuries were not included in the study. Ethical committee approval for the study was obtained from Fırat University's clinical research ethics committee.

Disease activity in patients with AS was measured using the Bath Ankylosing Spondylitis Disease Activity Index (BASDAI). Remission was defined as BASDAI < 4.[11] Disease activity in patients with acromegaly was measured using GH response and IGF-1 level after 75 g OGTT.[10] Asymptomatic patients in terms of Achilles tendinopathy were included in the study.

Sonoelastography

The dominant foot of participants was identified. Achilles tendon in the dominant foot of participants in all groups were evaluated with ultrasound, including B-mode, color and power Doppler, and sonoelastography. Ultrasonographically evaluation was performed by a radiologist who has over 7 years of experience in musculoskeletal radiology with a Philips Epiq 5 device. A linear probe with 5 MHz-12 MHz frequency range was used. Achilles tendon was examined in axial and longitudinal planes in the prone while the foot relaxed position over the examination bed. Doppler results were evaluated as normal or abnormal according to the slow flow. The thickness of the Achilles tendon in B-mode was obtained by calculating the anteroposterior diameter in the transverse view at the level of the medial malleolus. After performing the B-mode ultrasound, stiffness measurements of the Achilles tendon in the same position were obtained. The mean stiffness ratio of the Achilles tendon was determined by applying light compression and decompression perpendicularly to the tendon in the longitudinal plane to eliminate anisotropy and tissue shifting.[12] The examiner was blinded to the clinical condition of the participants.

Statistical analysis

Demographic and clinical characteristics of the groups were determined. Normality in the variables was assessed by the Kolmogorov–Smirnov test. Chi-square test was used for categorical data. Student's t test was used for the comparison of continuous measurements. Continuous data were given as mean ± standard deviation. Pearson correlation analysis was used for correlation analysis. The diagnostic efficacies of stiffness ratio were examined by receiver operating characteristic (ROC) analysis. $P < .05$ was considered statistically significant.

Results

The mean age of the groups was 40.81 ± 8.86 years (range: 24-57) in acromegaly patients, 37.15 ± 9.59 years (range: 22-52) in AS patients, and 38 ± 8.11 years (range: 26-53) in the healthy controls. In addition, 64% of the acromegaly group was female, 62% of the AS group was female, and 60% of the control group consisted of females. The body mass index (BMI) of the groups was 27.2 ± 5.9 kg/m^2 (range: 20-45) in acromegaly patients, 25.1 ± 2.9 kg/m^2 (range: 21-31) in AS patients, and 24.9 ± 3.2 kg/m^2 (range: 18-30) in the healthy controls. There were no statistically significant differences in age, gender, and BMI distributions among groups.

The thickness of Achilles tendon in the relaxed position was measured as 4.86 ± 0.54 mm in acromegaly patients, 4.51 ± 0.41 mm in AS patients, 4.25 ± 0.58 mm in the control group. The thickness of Achilles tendon was increased in patients with acromegaly compared to control and AS groups ($P = .001$ and $P = .038$, respectively). In addition, the thickness of Achilles tendon in AS patients was higher than the control group but not statistically significant ($P = .285$) (Table 1). Power Doppler was normal in all patients and controls.

The mean stiffness ratio of the Achilles tendon was measured as 0.62 ± 0.27 in acromegaly patients, 0.55 ± 0.29 in AS patients, and 0.50 ± 0.26 in the control group. The stiffness ratio of Achilles tendon was increased in acromegaly patients when compared to the control group ($P = .04$). Moreover, the stiffness ratio of Achilles tendon was higher in acromegaly patients compared to AS patients, but there was no statistical difference ($P = .521$) (Table 1).

The mean disease duration of acromegaly patients was 6.92 ± 3.52 years. In terms of disease activation, 67% of acromegaly patients were in remission, while 33% were active. The thickness of Achilles tendon in patients with active acromegaly was measured as 5.27 ± 0.91. There was no difference between patients with active and remission acromegaly patients in terms of thickness of Achilles tendon ($P = .233$). Similarly, the sonoelastography measurement of Achilles tendon was increased in active acromegaly patients compared to remission acromegaly patients, but there was no statistically significant difference ($P = .725$). There was no statistically significant difference in mean age and gender distribution between active and remission acromegaly patients ($P = .911$ and $P = .122$, respectively).

The mean disease duration of AS patients was 5.55 ± 3.28 years. 73% of AS patients were in remission, while 27% were active. The thickness of Achilles tendon in patients with active AS was measured as 4.64 ± 0.62 mm. There was no difference between patients with active and remission AS patients regarding the thickness of Achilles tendon ($P = .335$). Moreover, the stiffness ratio of Achilles tendon was measured as 0.80 ± 0.41 in active AS patients, while it was measured as 0.51 ± 0.14 in remission AS patients. There was a statistically significant difference ($P = .02$) (Figure 1). The C-reactive protein (CRP) level was measured as 6.1 ± 2.7 in active AS patients, while it was measured as 5.4 ± 2.4 in remission AS patients. There was no statistically significant difference in CRP level in the two groups ($P = .552$). Furthermore, all of these patients were receiving tumor necrosis factor inhibitors

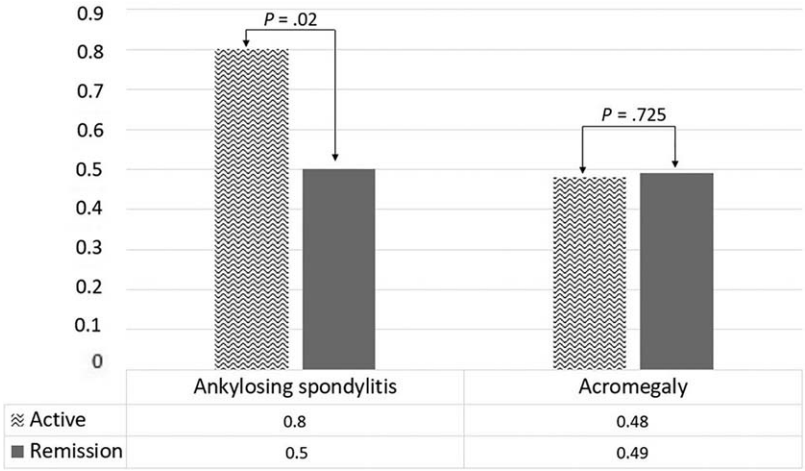

Figure 1. Sonoelastographic measurements of patients in active and remission.

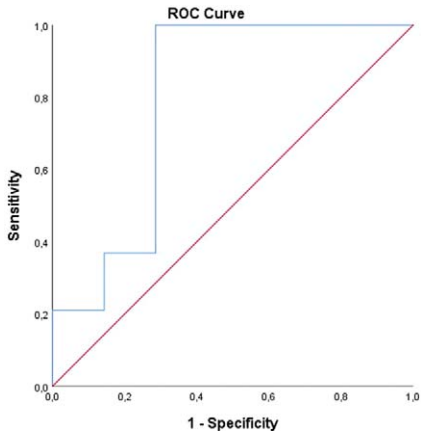

Figure 2. The ROC curve for the sonoelastography of Achilles tendons in active and remission AS patients.

treatment. On the other hand, there was no statistically significant difference in mean age and gender distribution between active and remission AS patients ($P = .820$ and $P = .124$, respectively). Based on the ROC analysis, the stiffness ratio of Achilles tendon (using a cutoff of .595) differentiated active AS patients from remission AS patients, with a sensitivity and specificity of 78.9% and 71.4%, respectively (Figure 2). In addition, a positive correlation was found between Achilles tendon stiffness ratio and disease duration in patients with AS ($r = .593$, $P = .021$).

Discussion

Acromegaly is frequently recognized in advanced-stage patients even with the inspection. However, this typical phenotype appearance is not formed in the early stages of the disease. In addition, these patients may apply with complaints such as joint pain, functional impairment in the joints, and tendinopathy, similar to AS patients. Achilles tendon can be involved in both AS and acromegaly patients.

This study has diversified importance in determining the sonoelastographic findings of the Achilles tendon in patients with AS and acromegaly.

In a study conducted by Podgorski et al.,[13] peripheral joint involvement in 74% of acromegaly patients and spinal involvement in 47% of acromegaly patients were reported. Acromegaly patients, who are mainly presented with joint complaints, can apply to the rheumatology departments. These patients may have SpA-like findings such as back pain, Achilles tendinopathy. On the other hand, when joint complaints in acromegaly patients are associated with acromegaly, it may cause delays in the diagnosis of possible SpA. Because there are case reports showing the coexistence of AS and acromegaly.[14,15]

There are many different reasons that disrupt the tendon structure. Achilles tendon is one of the most affected tendons. Achilles tendinopathy may be due to inflammation or excessive mechanical loading. May the characteristics of tendon tissue of the diseases with enthesopathy be different? With this question coming to mind, we thought that the Achilles tendon could be evaluated by sonoelastography in AS and acromegaly patients. Sonoelastography is currently used as a noninvasive method in the evaluation of different tissues. It has also been used in the evaluation of tendons for this purpose. Increased collagen synthesis in acromegaly patients may cause an increase in tendon thickness. In a study conducted by Onal et al.,[16] increased thickness of the Achilles tendon was shown in acromegaly patients compared to healthy individuals. In the same study, it was determined that the Achilles tendon's sonography had a soft tissue character in almost half of the acromegaly patients, and the other half had a hard tissue character. Approximately one-third of the Achilles tendon sonoelastography measurements of healthy individuals were found to be of soft tissue character, while the other two-thirds were of hard tissue character. In the same study, sonoelastography measurements showed that acromegaly patients' tendon thickness with soft tissue character was higher. In an experimental study, Nielsen et al.[17] showed that the collagen volume of the Achilles tendon of mice with growth hormone receptor defects decreased significantly. Studies showed that collagen synthesis in the human tendon is stimulated with GH.[18,19]

In a study performed on patients with ankylosing spondylitis, the US examination of the Achilles tendon revealed that the distal portion of the tendon was softer compared to those in healthy individuals. However, in patients with AS, the proximal and middle portion of the Achilles tendon was found to be stiffer. This condition was associated with erosion in the calcaneus and enlargement of the tendon. In the same study, no statistically significant difference was found between the AS and control groups in the Achilles tendon B mode US measurements.[20]

In our study, we detected that Achilles tendon thickness was increased in patients with acromegaly and AS compared to the control group. However, we could not determine a statistically significant difference in sonoelastography measurements between AS and acromegaly patients. On the contrary, there was a statistically significant difference in sonoelastography measurements in acromegaly patients compared to the control group. These results may be related to the treatment of acromegaly and AS patients included in the study. In this respect, not inclusion of newly diagnosed and untreated AS and acromegaly patients in the study is a limitation of our study.

Examination of only the dominant foot and evaluation of the Achilles tendon in only one region are the limitations of our study. Another limitation of this study was the sample size.

As a result, the thickness of Achilles tendon in patients with acromegaly and AS may be increased. In addition, the sonoelastography may be a useful parameter for the evaluation of Achilles tendon in patients with AS and acromegaly. However, due to the limitations of our current study, it cannot be concluded

that disease activity can be determined in AS patients with Achilles tendon sonoelastography. Because more comprehensive studies with large samples are needed to investigate Achilles tendon sonoelastography measurements in patients with acromegaly and AS.

Ethics Committee Approval: Ethics committee approval was received for this study from the Fırat University School of Medicine Noninvasive Research Ethics Committee (Approval Date: December 18, 2017; Approval Number: 236445)

Informed Consent: Written informed consent was obtained from the parents of the patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - A.K., S.S.K.; Design - A.K., K.U., H.A.; Materials - A.K., K.U., H.A.; Data Collection and/or Processing - A.K., K.U.; Analysis and/or Interpretation - A.K., S.S.K.; Literature Review - A.K., S.S.K.; Writing - A.K., K.U.; Critical Review - S.S.K.

Declaration of Interests: The authors have no conflict of interest to declare.

Funding: The authors declared that this study has received no financial support.

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