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Strain index values in the ultrasonographic evaluation of psoriasis

Mehmet Sait Menzilcioğlu[1]*, Serdal Çitil[2] , Yasemin Akman[3], Fatih Tüten[2]

Abstract

Objective: Psoriasis is a widespread, chronic, recurrent, inflammatory disease of the skin which affects men and women equally. Elastography is a novel technique which uses elasticity of the lesion. The aim of this study is to determine the elastographic findings of dermal psoriasis. This is the first study to evaluate SI in psoriasis patients and SI is helpful to evaluate psoriasis patients. We suggest that determining cut-off SI values for normal and dermal psoriasis can be helpful in the early diagnosis and follow-up of psoriasis patients.

Materials and Methods: This prospective study included a total of 21 (10 females, 11 males) healthy volunteers and 32 (17 females, 15 males) psoriasis patients between 2015 and 2016. An Aplio 500 ultrasound device (Toshiba Medical Systems Corp., Otawara, Japan) and a 5-13 MHz linear transducer were used for ultrasonographic and ultrasound elastographic examinations. The measurements were made from the flexor sides of upper and lower extremities. At least three measurements were performed for each lesion and strain index (SI) values were recorded

Results: The median SI values of healthy volunteers and psoriasis were 1.25 (0.16-8.00) (interquartile range (IR) 1.50) and 2.73 (0.43-13.32) (IR 3.39), respectively, indicating a significant difference between the groups (p: 0.001).

Conclusion: Our study results showed that the SI values of dermis in psoriasis patients were significantly higher than those of healthy volunteers. We suggest that determining cut-off SI values for normal and dermal psoriasis can be helpful in the early diagnosis and follow-up of psoriasis patients. Due to literature search, this is the first study to evaluate SI in psoriasis patients and SI is helpful to evaluate psoriasis patients.

Keywords: Elastography, Strain Index, Psoriasis.

Introduction

Psoriasis is a widespread, chronic, recurrent, inflammatory disease of the skin affecting men and women equally (1,2)(1,2). Its etiology is still unknown. Most psoriasis manifest with patches of thick, red skin with silvery scales. These patches usually involve the elbows, knees, scalp, lower back, face, palms, and soles of the feet (3). The differential diagnosis is made based on clinical findings and skin biopsy results (4).

Elastography is a novel technique which uses elasticity of the lesion (5). The principle of this technique is to acquire data about the stiffness of the tissue to assist the differential diagnosis. There are various types of ultrasound elastography. These methods can be divided as dynamic and quasi-static according to the type of force, while shear-wave and strain according to method. Shear-wave elastography is a dynamic method using shear-waves to obtain the data and presents quantitative value (6).

Acoustic Radiation Force Impulse (ARFI) elastography, transient elastography, and shear-wave elastography use shear-waves. In addition, strain elastography is divided into two types as qualitative real-time elastography and semi-quantitative strain elastography. Real-time elastography presents color scale according to the stiffness of the related tissue, and the operator classifies the stiffness according to the colors. Semi-quantitative strain elastography presents strain ratio or strain index (SI) using region of interests (ROI). Furthermore, strain elastography is operator-dependent due to the probe compressions and decompressions, while shear-wave does not need operator compressions with the aid of generating electro-mechanical waves (6- 8).

In the present study, we aimed to reveal the effectiveness of elastographic findings on dermal psoriasis.

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1 Gaziantep University, Faculty of Medicine, Dept of Radiology, Gaziantep, TR
2 Kahramanmaras Necip Fazıl City Hospital, Clinic of Radiology, Kahramanmaras, TR
3 Kahramanmaras Necip Fazıl City Hospital, Clinic of Dermatology, Kahramanmaras, TR
*** Corresponding Author:** Mehmet Sait Menzilcioğlu **E-mail:** dr.m.sait@hotmail.com **Phone:** +90 342 3606060

Material and Methods

Informed consent form was obtained from all patients and the study was performed in accordance with the ethical guidelines of the Helsinki Declaration and approved by the committee of Sütçü İmam University approved in this study . No financial support was received for the present study. This prospective study included a total of 21 (10 females, 11 males) healthy volunteers and 32 (17 females, 15 males) psoriasis patients between 2015 and 2016. The inclusion criteria were as follows: previous psoriasis diagnosis, absence of any coexistent skin lesions except psoriasis, and not using drugs affecting the skin, except drugs for psoriasis. Patients with non-psoriatic skin lesions were excluded.

An Aplio 500 ultrasound device (Toshiba Medical Systems Corp., Otawara, Japan) and a 5-13 MHz linear transducer were used for ultrasonography (USG) and ultrasound elastography examinations. The USG examinations were performed by a single radiologist who had more than 10 years of experience on the use of USG. All measurements were made particularly from the flexor sides of upper and lower extremities. At least three measurements were performed for each lesion and SI values were recorded

Elastography examination was made following routine USG imaging, applying mild compression and decompression to the affected skin surface of the extremity. The screen was divided into three parts, while elastography was active, as left, right, and bottom. The color coded left side indicated elastography mode, while the right side indicated the routine B mode, and the bottom side indicated the sinusoidal wave, which assists the user to follow regular compression and decompressions. The symmetrical sinusoidal wave means regular compression and decompression. The measurements were applied, adjusting the ROI to the psoriasis lesions and adjacent muscles (Figure 1).

Statistical Analysis

Statistical analysis was performed using SPSS version 21 software (IBM Corp., Armonk, NY, USA). Descriptive statistics were used for demographic data. One-sample Kolmogorov-Smirnov test was used to analyze for normality. The Mann-Whitney U test was used to analyze significant differences between SI of healthy controls and psoriasis group. The receiver operating characteristic (ROC) curve was used to define the cut-off value for SI. A value of the mean SI of normal healthy individuals and patients with respectively, p: 0.001 was considered statistically significant.

Results

A total of 21 (10 females, 11 males) healthy volunteers and 32 (17 females, 15 males) psoriasis patients were included. The mean ages of healthy volunteers and psoriasis patients were 33.62±11.76 (range: 17 to 61) years 40.59±15.24 (range: 15 to 74) years. There was no significant difference in the mean age between the groups (p: 0.094).

The median SI values of healthy volunteers and psoriasis patients were 1.25 (range: 0.16 to 8.00; interquartile range (IR) 1.50) and 2.73 (range: 0.43 to 13.32; (IR 3.39), indicating a significant difference between the groups (Mann-Whitney U test, p: 0.001).

The ROC curve revealed a cut-off value of 1.91 to differentiate the psoriasis patients from healthy volunteers (the maximum value of sensitivity+specificity) (Figure 2).

The sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, negative likelihood ratio, and power were 62.5%, 81%, 83.3%, 58.6%, 3.28 (range: 1.31 to 8.25), 0.46 (range: 0.28 to 0.76), and 70%, respectively.

Table 1: Demographic Data of the Participants. There was no significant difference in the mean age between the groups.

Parameters	Healthy Volunteers n=32 (17 to 61)	Psoriasis Patients n=21 (15 to 74)	P Value
Age	33.62±11.76	40.59±15.24	0.094

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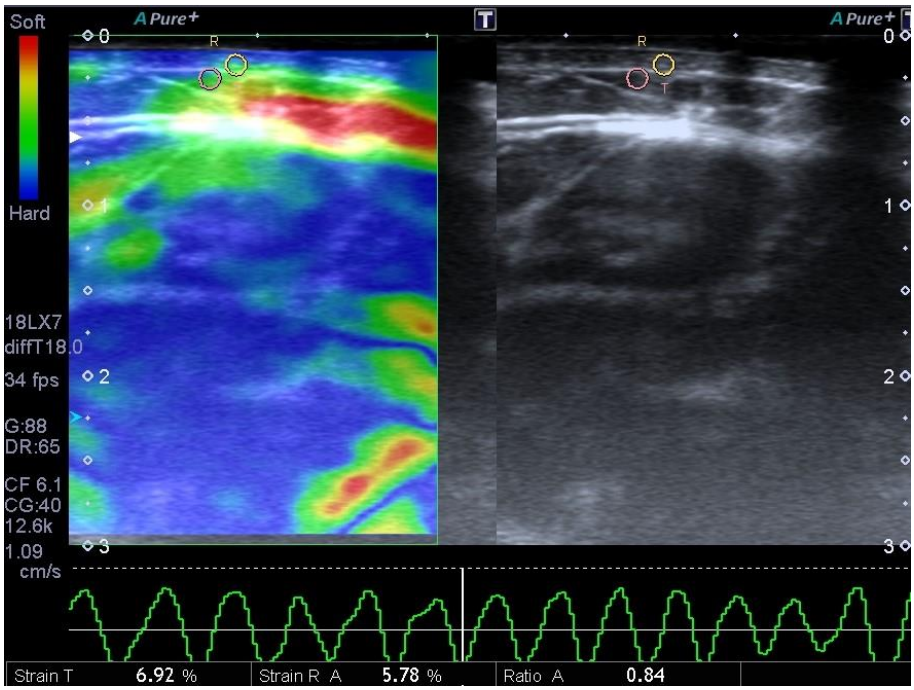

Figure 1: An ultrasound elastography image showing dermal psoriasis. The screen is divided into three parts: right side is gray scale USG image, left side is color coded USG elastography image, and the bottom side is the sinusoidal wave of compression and decompression. The circles indicate the ROIs. Measurements were applied adjusting the ROI to the psoriasis lesions and adjacent muscles.

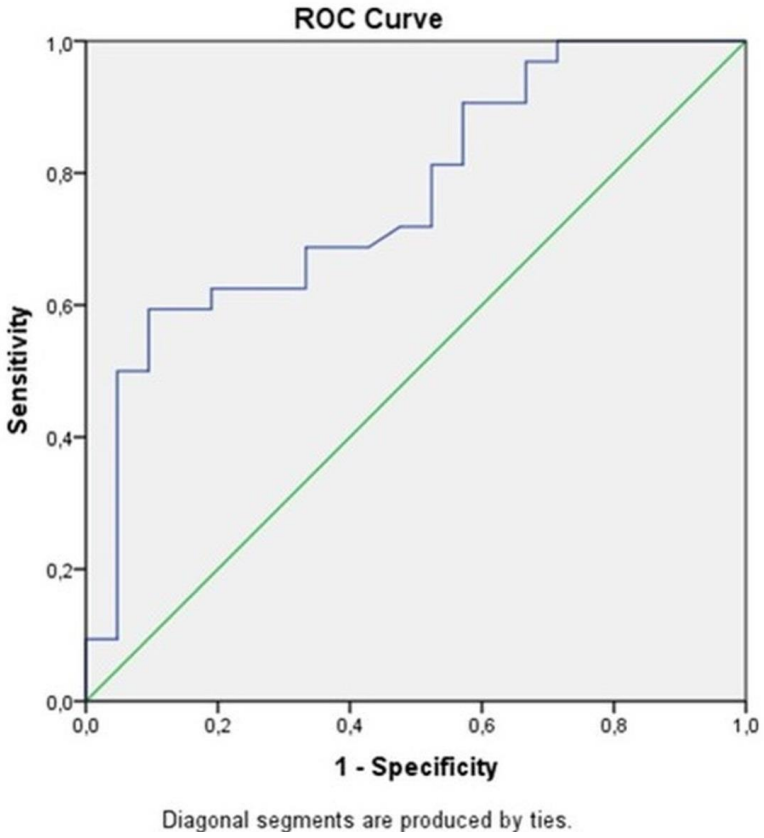

Figure 2: The ROC curve of healthy volunteers and psoriasis. The cut-off value was 1.91 and the AUC was 0.764 with a standard error of 0.067 and confidence interval of 95% (0.634-0.895).

Discussion

Elastography is a novel technique which uses the stiffness of the lesions to diagnose. In the literature, there is no published study about elastography about psoriasis, although more studies exist about ultrasound elastography. In this study, we aimed to determine the elastography measurements of psoriasis lesions. The diagnosis of psoriasis is based on history, clinically and sometimes skin biopsy results. Biopsy is required in the differential diagnosis of similar lesions, such as seborrheic dermatitis, mycosis fungoides fungoides, and lichen planus (9,10).

Elastography measures the stiffness of the tissue. Accordingly, several studies were carried out made using elastography to differentiate malignant lesions from the benign ones (7). In addition, ultrasound elastography is reliable in differentiating benign and malignant breast lesions (11-13).

In the present study, there was a significant difference in the SI values of psoriatic and normal skin lesions. The difference can be attributed to the local tissue inflammation which makes the tissue stiffer.

Nonetheless, there are some limitations to our study. First, the thin skin surface did not allow adjusting the ROI; therefore, only thick lesions were selected for the measurement. Second, we only compared the psoriatic and normal skin lesions; however, further studies are required to examine more skin disorders such as psoriasis. As a result, our results did not allow differentiating psoriasis from the psoriasis-like lesions.

Conclusion

Our study results showed that the SI values of dermis in psoriasis patients were significantly higher than those of healthy volunteers. We suggest that determining cut-off SI values for normal and dermal psoriasis can be helpful in the early diagnosis and follow-up of psoriasis patients. Also, to the best of our knowledge, this is the first study to evaluate SI in psoriasis patients, and SI is helpful to evaluate psoriasis patients. However, further large-scale studies are required to establish a definite conclusion.

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Conflict of Interest: The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Author's Contributions: **MSM;** Research concept and design **MSM, SÇ, YA, FT;** Patient examination Research the literature preparation of the article. **MSM;** Revision of the article.

Ethical issues: All Authors declare, originality and ethical approval of research. Responsibilities of research, responsibilities against local ethics commission are under the Authors responsibilities.

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