

The measurement of leg muscle hardness in Duchenne type muscular dystrophy patients, using Elastography

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Abstract

We assessed the hardness of muscle in two patients with Duchenne muscular dystrophy (DMD). Patient 1, an 11-year-old man, was able walk independently. Patient 2, a 27-year-old could not walk without assistance and required respirator for 24 hours a day. In Patient 1, the muscular tissue of the musculus rectus femoris was indistinctly depicted by sonography. The muscular tissue of the medial head of the gastrocnemius muscle could be observed clearly. In Patient 2, the musculus rectus femoris and the muscular tissue of the calf of leg medial head were indistinct. On the other hand, fibrosis-like tissue was confirmed. The strain ratio was higher in Patient 2 in the musculus rectus femoris, medial head of the gastrocnemius muscle compared with Patient 1. Supersonic wave Elastography can measure hardness change caused by the fiberization of the muscular tissue in DMD.

Keywords: Duchenne muscular dystrophy, DMD, real-time tissue elastography, strain ratio

Introduction

Muscular dystrophy is progressive muscular disease to assume destruction / the degeneration of the line the main lesion. Duchenne muscular dystrophy (DMD) is the form showing the most frequent development. DMD is an inherited disease that causes striated muscle weakness, for which a cure is currently not available [1]. Pharmacological drug treatment for this disease is limited almost exclusively to corticosteroids, which result in prolonged ambulation in patients for up to two years and possibly a delay in respiratory function

decline [2-7]. For this disorder, CT or MRI are used for the evaluation of the line. However, a qualitative evaluation is necessary to determine the condition of a patient of the line. A factor expressing the qualitative state includes "hardness". In recent years, supersonic wave elastography has attracted attention as a method of capturing this "hardness" objectively.

Subjects and methods

Supersonic wave Elastography can measure the lower limbs skeletal muscle hardness quantitatively. The subjects were two patients with DMD. The target of the

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measurement was the musculus rectus femoris and the medial head of the gastrocnemius muscle. We measured the distortion level of the tissue using real-time tissue elastography by means of ultrasonic diagnostic equipment (Hitachi Avius, Tokyo, Japan). We calculated a relative ratio (Strain Ratio) of target (a target line) for the material (an acoustic coupler) that hardness was homogeneous. This strain ratio was used to create an index of muscle rigidity. The strain ratio gives a firm thing a high value. The measurement attitude was conducted in rest decubitus. A common checker measured three times. The mean of the three measurements was calculated. Patient 1 was an 11-year-old man. He was able to walk independently. Patient 2 was a 27-year-old man. Walking and maintaining a sitting posture were not possible for him. The patients wore a respirator for 24 hours a day.

Results

In Patient 1, the muscular tissue of the musculus rectus femoris was indistinctly depicted by the sonography. The muscular tissue of the medial head of the gastrocnemius muscle could be observed

clearly. In Patient 2, the musculus rectus femoris and the muscular tissue of the calf of leg medial head were indistinct. On the other hand, fibrosis-like tissue was confirmed (Figure 1). The strain ratio was higher in Patient 2 in the musculus rectus femoris, medial head of gastrocnemius muscle compared with Patient 1 (Figure 2).

Discussion

Most of the emphasis in muscular dystrophy – in research as well as treatment – has been on the degeneration of skeletal muscle fibers. Comparatively little attention has been paid to the pathogenesis of the well-developed fibrosis and fat replacement in the affected muscle tissues. Possibly this lack of attention would not have occurred if the suggestion of Guillaume-Benjamin Amand Duchenne to call the respective pathology 'paralytic myosclerosis' [8] had been taken up. In fact this type of pathology had been called 'pseudohypertrophic muscular dystrophy' for several decades prior to the suggestion of John Walton and Frederick Nattrass in 1954 to use the term 'Duchenne dystrophy' which has now become the prevailing fashion [9].

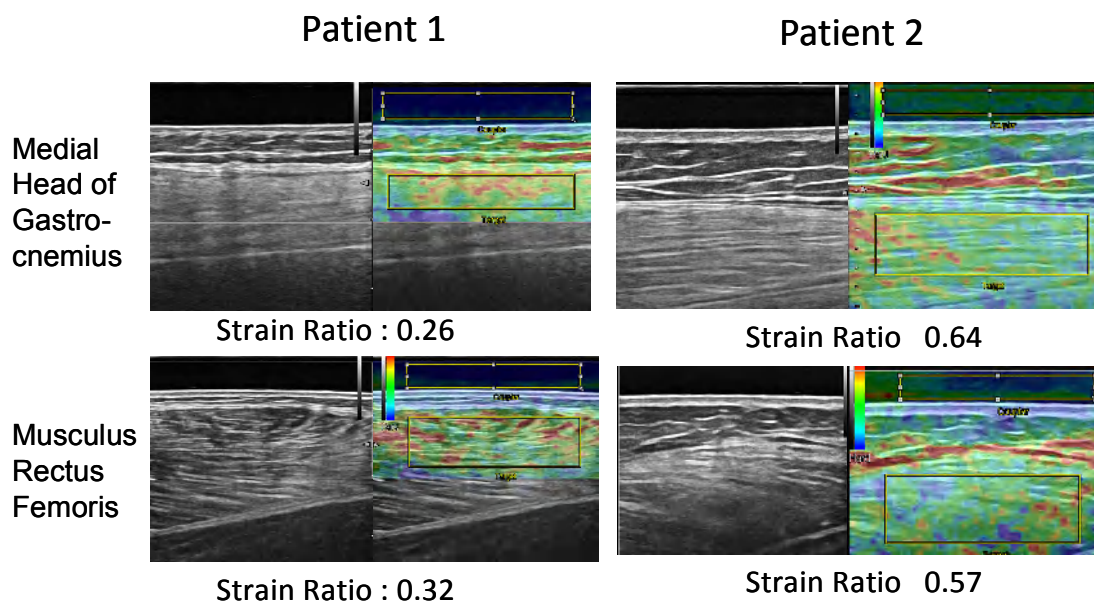


Figure 1. Ultrasonography and real-time tissue elastography of musculus rectus femoris and medial head of gastrocnemius muscle in Patients 1 and 2.

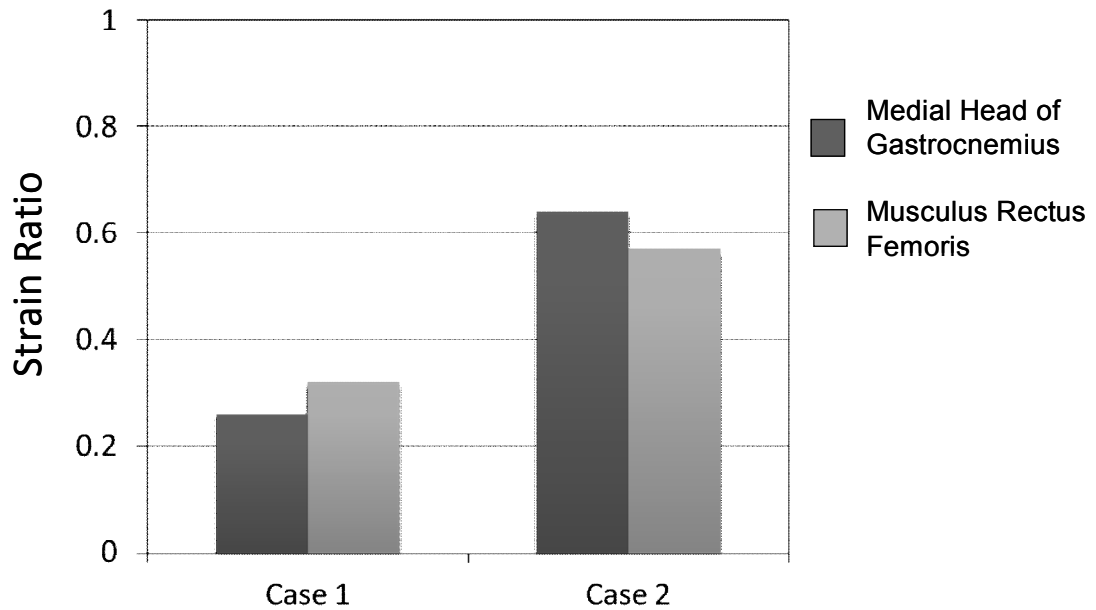


Figure 2. Strain ratio of musculus rectus femoris and medial head of gastrocnemius muscle in Patients 1 and 2.

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