

Correlations of MRI and P-31 MRS Data with Clinical Parameters: Juvenile Dermatomyositis

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INTRODUCTION: Juvenile dermatomyositis (JDM) is characterized by severe proximal muscle weakness, fatigue and a typical rash. Prednisone, which is the mainstay of treatment for JDM, has serious side effects such as growth retardation, changes in bone density, and cataract development. Non-invasive, repeatable diagnostic procedures are therefore highly desirable for optimizing therapeutic regimes. MRI and P-31 MRS have been used for quantitative evaluation of both JDM and adult DM (1). In this study, MRI and MRS data were compared with each other and with clinical data such as serum CPK levels, Health Assessment Questionnaires (M-HAQ), daily activities, fatigue, weakness, and pain (2,3). The purpose of this investigation was to determine the relative utility of each of the procedures for evaluation of JDM patients.

METHODS: The subjects included 11 JDM patients and 6 normal control children. T1- and T2-weighted images of the thigh were acquired with a 1.5 T magnet. T1 and T2 relaxation times were calculated for quantitative evaluation of inflammation. P-31 MR spectra of the quadriceps muscles were obtained during rest, graded levels of exercise, and recovery following exercise. ATP, PCr and Pi levels were determined from the resonance areas under the peaks, as previously described (4). Each subject completed a modified Health Assessment Questionnaire (M-HAQ). Fatigue, weakness and pain were measured on a 10 cm visual analog scale (VAS). Comparisons of JDM patients and controls were performed using Students 2-tailed t-test. Statistical correlations of MR values and clinical data were determined by regression analyses ($r > 0.65$ and $P < 0.05$ were considered significant).

RESULTS: JDM patients and normal controls showed statistically significant differences for all parameters: T1 and T2 relaxation times, ATP and PCr levels, M-HAQ scores, daily activities, fatigue, weakness and pain. ATP levels revealed the most highly significant P value (0.000007), followed by fatigue (0.00003), PCr levels (0.00009), and T2 values (0.0001). Regression analyses of JDM data provided another statistical pattern. Correlations between ATP and PCr levels were more highly significant than those of T1 and T2 values ($r = 0.94$ and 0.69 , respectively). In comparisons of MRS and MRI data, ATP or PCr showed more significant correlations with T2 values ($r = -0.87$ and -0.85) than with T1 values ($r = -0.81$ and -0.76). All MR data were highly correlated with M-HAQ scores: versus ATP ($r = -0.96$), PCr ($r = -0.92$), T2 values ($r = 0.91$), and T1 values ($r = 0.82$) (Figure 1). By contrast, MR data did not correlate with any other clinical data, including serum levels of CPK, fatigue, weakness, and pain.

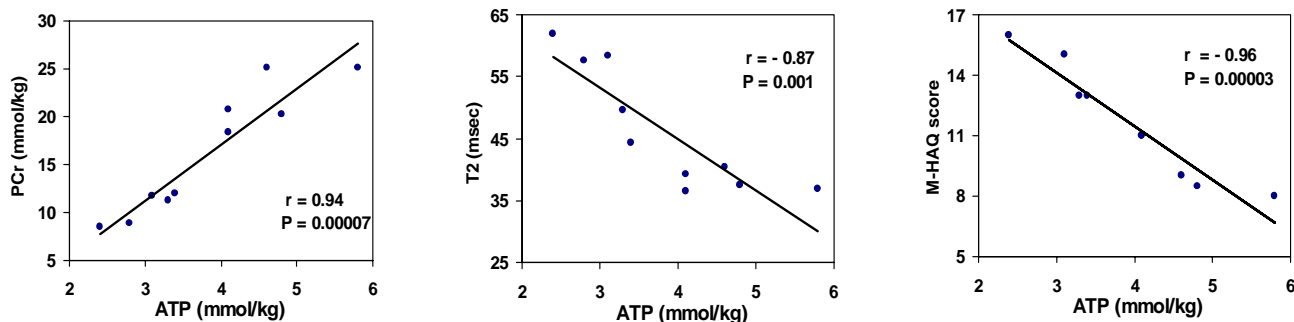


Fig. 1: Correlation of ATP levels versus PCr, T2 values and M-HAQ.

DISCUSSION: The overall statistical comparison of JDM patients and control children showed significant differences for all the MR and clinical parameters. For internal JDM comparisons using regression analyses, only certain parameters were statistically correlated. A high degree of correlation was observed between ATP and PCr levels, but correlations between T1 and T2 values were not as strong. Comparisons of ATP or PCr with T2 values were more highly correlated than with T1 values. This suggests that T2 values may be a more useful indicator of muscle damage than T1 values. The correlations between MR data and the M-HAQ scores provided some of the most significant correlations obtained in the study. This indicates that the M-HAQ with its very specific questions is a valuable tool for evaluation of JDM. The VAS measurements of fatigue, weakness, and pain did not correlate with any of the MR data; therefore, in this group of patients, these parameters were not accurate measures in the initial, quantitative evaluation of JDM. Different patients or their parents may evaluate fatigue, weakness and pain in a highly subjective, individualized manner.

In conclusion, MRI, P-31 MRS and M-HAQ scores provide quantitative data and useful information regarding the muscle status as well as verification of the physician's clinical impression.

- References** 1. Park, JH, et al. Arthritis Rheum. 37: 736-746, 1994. 2. Rider, GR. Rheum. Dis. Clin. N. Am. 28: 935-977, 2002. 3. Miller, FW, et al. Rheumatology 40: 1262-1273, 2001. 4. Park, JH, et al. Arthritis Rheum. 43: 2359-2367, 2000.