Quantitative MRI can Distinguish Myositis From Healthy Control Muscle.

Farrow, M[1,2]. Biglands, J[2]. Tanner, S[2]. Buch, M[1,2]. Emery, P[1,2]. Grainger, A[1,2].Tan, A L[1,2]

[1] Leeds institute of Rheumatic and Musculoskeletal Medicine, University of Leeds, [2] NIHR Leeds Biomedical Research Centre, Chapel Allerton Hospital

Background: Myositis is an autoimmune disease which can decrease quality of life and increase mortality. Clinical presentation includes muscle weakness, changes in muscle microstructure, myosteatosis, raised muscle enzymes and myalgia. Currently, diagnosis is reliant on subjective clinical examinations, blood tests and invasive muscle biopsies. Quantitative MRI techniques such as Diffusion tensor imaging (DTI) and Fat Fraction (FF) measurements offer non-invasive measurements, which could help improve the understanding of muscle pathology and potentially inform diagnosis. DTI measures water diffusion within tissues which is sensitive to changes in muscle microstructure [(1)]. FF provides a quantitative measure of myosteatosis in muscles [(2)].

Objective: To evaluate whether FF and mean diffusivity measurements are sensitive enough to detect muscle differences in myositis patients compared to healthy controls.

Methods: 10 active myositis patients (6 female, mean age 55 ± 18) diagnosed according to the Bohan and Peter myositis criteria (mean CK 2,015 ± 10,787) and 16 healthy controls (10 female, mean age 44 ± 17), were imaged using STEAM-EPI diffusion and 2-point Dixon. Myositis patients included 5 polymyositis, 3 dermatomyositis and 2 inclusion body myositis. Mean measurements of FF and mean diffusivity (MD) were obtained from regions drawn manually within the individual muscles of the quadriceps and hamstrings. In addition to MRI, all participants had knee extension and flexion power and torque measured. Differences were assessed using independent T-tests.

Results: FF and MD were higher in myositis patients compared to healthy controls, whereas muscle strength and power were reduced.

		Mean		**Mean difference (95% CI)**		**Significance (p value)**	
		Hams	**Quads**	**Hams**	**Quads**	**Hams**	**Quads**
FF (%)	**Myositis**	15.09 (-9.21, 39.39)	14.33 (-16.95, 45.6)	10.08 (5.12, 15.05)	11.2 (5.79, 16.61)	<0.001	<0.001
	Healthy	5.0 (-4.89, 14.82)	3.13 (-0.28, 6.54)				
MD (x10^{-3}mm^2/s-1)	**Myositis**	1.31 (1.15, 1.47)	1.26 (1.05, 1.47)	0.087 (0.00, 0.17)	0.02 (-0.05, 0.09)	0.046	0.02
	Healthy	1.22 (0.69, 1.75)	1.23 (0.75, 1.72)				
	Healthy	37.68 (6.8, 68.55)	63.80 (6.98, 120.63)				

Conclusions: MRI based FF and DTI measurements can detect muscle differences between myositis and healthy control groups. These differences are consistent with increased myosteatosis, increased oedema and the effects of muscle fibre plasticity. These measures show potential as novel imaging biomarkers in the diagnosis and management of myositis.

References

1. Qi *et al*. Journal of magnetic resonance imaging. 2008
2. Willis *et al*. 2013