

THE POTENTIAL ROLE OF SHEAR WAVE ELASTOGRAPHY FOR DIAGNOSING IDIOPATHIC INFLAMMATORY MYOPATHIES

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Background: Idiopathic inflammatory myopathies are a group of autoimmune muscle disorders characterised by muscle pain, stiffness and weakness. Diagnosis can be challenging; it relies on subjective clinical assessments, expensive MRI scans and invasive muscle biopsies. Novel quantitative ultrasound technologies like shear wave elastography could provide a new valuable non-invasive bedside imaging biomarker for diagnosis and management.

Objectives: 1- to determine if there are any muscle elasticity differences between myositis patients and healthy controls. 2- to test the correlation between elasticity and measures of strength, function and muscle enzymes (disease activity).

Methods: Muscle elasticity, evaluated using shear wave velocity (SWV), was measured in 16 active myositis patients (5 males/11 females; 5 dermatomyositis, 5 polymyositis, 2 inclusion body, 4 undifferentiated) with a mean age of 51.3 years and 26 healthy controls (8 males/20 females) with a mean age of 42.0 years. Active myositis was defined as a decreased muscle strength and an elevated muscle enzyme. The investigated muscles included the four quadriceps [vastus lateralis (VL), rectus femoris (RF), vastus medialis (VM) and vastus intermedius (VI)], the three hamstrings [biceps femoris (BF), semitendinosus (ST) and semimembranosus (SM)] and the biceps brachii (BB). The myositis patients performed the expanded timed-get-up-and-go (ETGUG) test to assess walking function in addition to the handgrip strength and isokinetic knee extension/flexion tests to assess muscle strength. Mann-Whitney test and Spearman's correlation coefficients were utilised to test for difference and correlation respectively.

Results: Myositis patients had a significantly lower SWV ($p < 0.001$) in all muscles except the BB (table). The mean elasticity difference ranged from 12% for VM to 21.1% for SM (table 1). Muscle enzyme (creatinase kinase) correlated with SWV for the VM ($r = 0.50$; $p = 0.04$) and BB ($r = 0.55$; $p = 0.03$). A strong correlation was detected between ETGUG walking time and VL ($r = -0.73$) as well as VI ($r = -0.64$). Handgrip strength correlated with VL, RF and BF ($r = 0.64, 0.56$ and 0.62 respectively). There was, however, no significant correlation between SWV and isokinetic knee strength.

Conclusions: Muscle elasticity in myositis patients has been shown to be 21% lower in comparison to healthy participants and seems to moderately correlate with muscle's strength and function. To our knowledge, this is the first study to show that shear wave elastography can detect changes in muscle elasticity in myositis patients. Further validation is required to evaluate the value of this novel ultrasound technology as an imaging biomarker for myositis.

Table 1 Mean SWV and differences in the examined muscles between myositis patients and controls.

<u>Muscle</u>	Shear wave velocity (m/s)		Mean difference (95% CI)	Difference percentage	Significance (p value)
	Healthy	Myositis			
Vastus lateralis	1.74	1.42	-0.32 (0.19, 0.46)	18.4%	<0.001*
Rectus femoris	1.77	1.53	-0.24 (0.12, 0.34)	13.6%	<0.001*
Vastus medialis	1.66	1.45	-0.21 (0.06, 0.35)	12.7%	<0.001*
Vastus intermedius	1.89	1.60	-0.29 (0.11, 0.47)	15.3%	<0.001*
Biceps brachii	1.94	1.79	-0.15 (-0.01, 0.30)	7.7%	0.088
Biceps femoris	1.73	1.38	-0.35 (0.24, 0.46)	20.2%	<0.001*
Semitendinosus	1.72	1.45	-0.27 (0.09, 0.43)	15.7%	<0.001*
Semimembranosus	1.75	1.38	-0.37 (0.28, 0.45)	21.1%	<0.001*