Idiopathic inflammatory myositis: Analysis of Magnetic Resonance Imaging using IDL to enhance diagnosis

C. E. Hutchinson[1], H. Chaney[2], R. C. Cooper[3], J. E. Kilgallon[4]

[1]Imaging Science and Biomedical Engineering, University of Manchester, Manchester, United Kingdom, [2]Student, University of Manchester, Manchester, United Kingdom, [3]Rheumatology, Salford Royal Hospital NHS Trust, Salford, United Kingdom, [4]Medical Physics, Christie Hospital NHS Trust, Manchester, United Kingdom

Idiopathic inflammatory myopathies (e.g. polymyositis and dermatomyositis) are rare but potentially serious conditions which, due to the potential toxicity of the high dose corticosteroid treatment agents, require definitive diagnosis plus accurate monitoring of disease progression. Magnetic Resonance (MR) imaging, with its superlative soft tissue contrast capabilities, has the potential to facilitate a qualitative assessment of the presence and extent of myositis disease activity (muscle inflammation) and damage (atrophy and fat replacement). Quantification of the disease and damage could improve therapeutic decisions. Previously submitted work has shown that it is possible to quantify the images and to improve the separation of normal from abnormal by using analysis written in IDL. MATERIALS AND METHODS: An in-house algorithm was developed to analyse the MR images of patients with suspected and/or proven myositis.(ISMRM 2003) The software categorises the muscle components into normal and abnormal tissue groups based on signal intensity, enabling the presence and location of disease and damage to be demonstrated plus the quantification of disease via abnormal to normal tissue ratios. Correlation between the abnormal tissue ratios generated by the algorithm and patients' circulating creatine phosphokinase (CK) levels, biopsy, MR reports and with a clinical marker of myositis disease activity, were investigated.

Results

MR reports: Table1

IDL analysis MR report	Positive	Negative	Total
Positive	8	20	28
Negative	5	12	17
Total	13	32	45

Using Fisher's exact test: Two sided P > 0.9999

CPK: Table 2

IDL analysis CPK	Positive	Negative	Total
Positive	10	22	32
Negative	2	8	10
Total	12	30	42

Using Fisher's exact test: Two sided P = 0.5367

Biopsy: Table 3

IDL analysis Biopsy	Positive	Negative	Total
Positive	3	0	3
Negative	0	11	11
Total	3	11	14

EMG: Table 45

IDL analysis EMG	Positive	Negative	Total
Positive	1	2	3
Negative	0	7	7
Total	1	9	10

Using Fisher's exact test: Two sided P = 0.3

Clinical: Table 5

IDL analysis Clinical	Positive	Negative	Total
Positive	7	0	7
Negative	0	17	17
Total	7	17	27

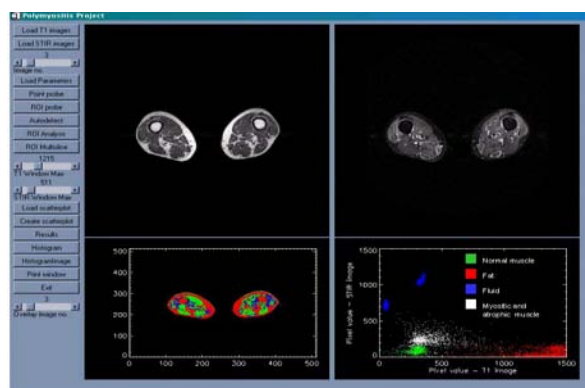Using Fisher's exact test: Two sided P < 0.0001

Figure one
T1 weighted image and STIR image showing both atrophy (fat infiltration and inflammation – myositis - in the muscle).
Using Fisher's exact test: Two sided P = 0.0027

Discussion

In keeping with other studies the we found that the CPK and EMG to be unreliable in confirming the diagnosis of myositis. The most reliable method is the overall clinical assessment which users the Boham and Peter criteria. Using this as the gold standard gives the IDL based analysis a sensitivity and specificity of 100% . Of the fourteen patients in whom the histology was available also showed a 100% sensitivity and specificity. The CPK EMG and MR visual reporting were in each case much less sensitive and specific. The major error in the MR reporting appeared to be in the under reporting of patients with myositisas diagnosed by clinical criteria (scoring ≥4/9) when comparing to the performance of the MR images as reported by the analysis method.

Reference:
J E Kilgallon, C E Hutchinson, G. Coutts, J Fairfoul and A P Jones 'Quantitative differentiation of myositis and atrophied muscle using MR imaging' ISMRM 2003