DIFUSSION TENSOR IMAGING STUDIES IN LIMB-GIRDLE MUSCULAR DISTROPHIES

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Introduction: Limb-girdle muscular dystrophies (LGMD) are a group of autosomal dominantly or recessively inherited muscular dystrophies that also present with primary proximal (limb-girdle) muscle weakness. This type of dystrophy involves the shoulder and pelvic girdles, distinct phenotypic or clinical characteristics are recognized. LGM dystorphies affect posterior thigh muscle compartment, predominantly gracilis and sartorius muscles. In the thigh, muscles at the back are affected, with a tendency to preserve the tibialis anterior and gastrocnemius[1].

Material and method: Eleven patients and eight healthy volunteers were examined as follows: all subjects were scanned while in the supine position with thighs relaxed and parallel to the magnet magnetic field direction(Figure 1). Images were acquired on a 1.5T imager (GE Medical Systems, WI, USA), using a combination of two eight-channel coil array. Diffusion Tensor Imaging (DTI) data were acquired using a SE-EPI sequence with the following parameters: TR/TE = 3000/71 ms, FOV=42x42 cm^2, matrix = 128x128, slices number= 17 and NEX = 10. Diffusion weighted gradients were applied along 30 non-collinear directions with a b-value=550 s/mm^2. High-resolution images were acquired using Fast Spin-Echo with the following parameters: TR/TE=600/23ms, slice thickness 8mm, matrix=256x256 and NEX=2. *Tractography:* Two regions of Interest (ROI) were hand-drawn containing all seventeen slices of the Gracilis and Sartorius muscles for each subject and fiber tracking of the primary and secondary eigenvectors was performed with *TrackVis* software [2], using the interpolated streamline algorithm with 0.5 mm step size [3-5]. (Figure 2.)

Results: The statistics for fractional anisotropy obtained from DTI data by averaging over each VOI for both the sartorius and gracilis muscles of healthy controls and patients. The tractography and net calculations were repeated 5 times and their means computed for each subject. All measurements were normalized to the VOI size. The connective tissue content does not appear to have a significant effect on the directionality of the diffusion, as assessed by fractional anisotropy. The sartorius muscle and gracilis fibers have a lower tract number, secondary to fatty infiltration and replacement of connective tissue and muscle mass loss characteristic of the underlying pathology.

Conclusions. Our results demonstrated the utility of non-invasive MRI techniques to characterize the muscle pathology, through quantitative and qualitative methods such as the FA values and tractrography. Correlation coefficients were negative between Number of tracts/Volumen and FA values for Sartorius and Gracilis muscles in patients.
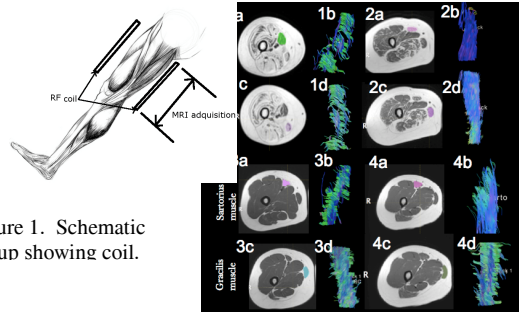

Figure 1. Schematic set up showing coil.

Figure 2. Comparison between 2 patients (1,2) with LGMD and two healthy controls (3,4), in blue primary tracts and green secondary tracts for the Sartorius and Gracilis muscle.
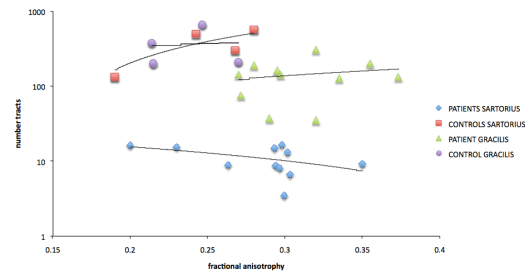

Figure 3. Fractional anisotropy average values vs number of tracts

	FA		NUMBER OF TRACTS		Tracts/Volumen	
	PATIENTS	CONTROLS	PATIENTS	CONTROLS	PATIENTS	CONTROLS
SARTORIUS MUSCLE	0.28451±0.01621998	0.24508±0.0095	47.54±30	375.25±200	10.95±6.3	20.11±2.81
GRACILIS MUSCLE	0.309735±0.01162	0.2364±0.004	20.118±12.232	20.14±2.833	7.58±5.7	16.35±1.98

Table 1. Patients and controls, FA for Sartorius and Gracilis muscles. number of tracts, and tracts over the complete region of the muscleper unit of volumen.

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