

High-resolution MR Imaging Of Bone-Muscle-Fat

In Glucocorticoid Treated Boys With Duchenne Muscular Dystrophy: Results from the ScOT-DMD study

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Background

The pathophysiological mechanism of skeletal fragility in Duchenne Muscular Dystrophy (DMD) is unclear.

Objectives

To compare trabecular bone microarchitecture, cortical geometry, muscle inflammation and fat fraction at distal femur and vertebral bone marrow adiposity (BMA) in DMD and controls.

Methods

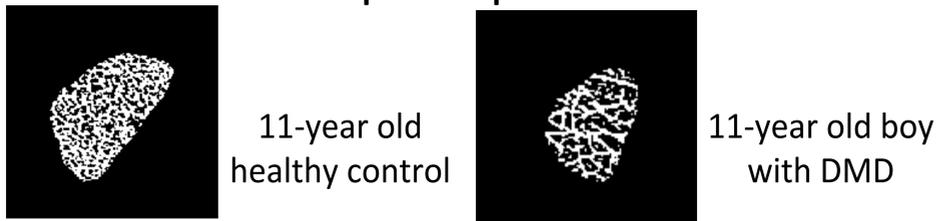
Bone-muscle and muscle fat fraction (FF) were assessed using 3T MRI and quantitative Dixon technique. BMA was assessed using 1H-MRS. Results expressed as median (range). Cortical parameters were compared following adjustment for femur length, muscle area, and age.

Results

Table 1: Cohort characteristics

	DMD	Control	p-value
Number of cases (n)	16	25	
Age (years)	11.7 (8.8,18.8)	13.0 (8.1,18.1)	0.694
Height SDS	-1.5 (-4.9,1.0)	0.5 (-0.8, 1.6)	0.001
BMI SDS	2.7 (-1.4, 3.5)	0.0 (-1.0,1.3)	0.004
Non-ambulant cohort (n)	10/16 (63)	-	
Length of non-ambulant status (years)	2.1 (1.1, 5.3)	-	
GC therapy (n)	16/16 (100)	-	
GC length (years)	5.9 (1.5, 10.5)	-	

Figure 1: CISS (Constructive Interference in the Steady State) pulse sequence



Comparison of Trabecular Parameters showed significantly lower apparent Bone Volume against Total Volume (appBV/TV) and apparent Trabecular Thickness (app TbTh) in DMD cases

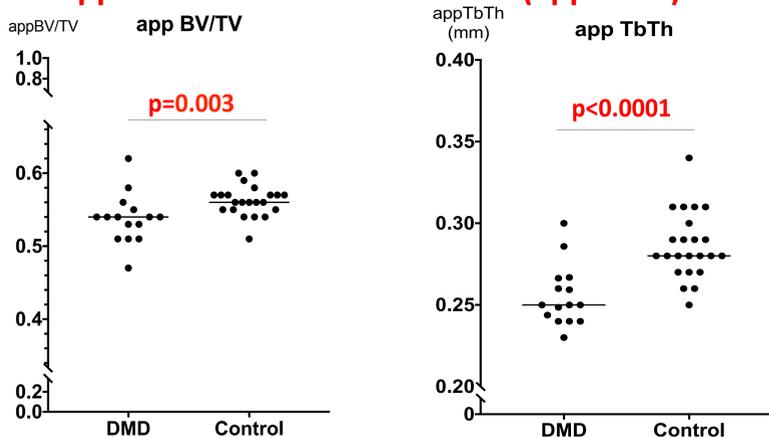


Figure 2: T1-weighted turbo spin echo (TSE) pulse sequence Comparison of Cortical Bone Parameters showed significantly lower Mean Cortical Thickness and Cortical Area in DMD cases



Cortical Parameter	B	95%CI	p-value
Endosteal Circumference (mm)	-9.9	-22.3 to 2.6	0.12
Periosteal Circumference (mm)	-9.2	-20.6 to 2.2	0.11
Mean Cortical Thickness (mm)	-0.7	-0.9 to -0.4	<0.0001*
Mean Cortical Area (mm ²)	-83.2	-113.0 to -53.5	<0.0001*

Results continued

Fig 3: 6-point gradient echo Dixon sequence Muscle Fat Fraction (FF%) is significantly higher and increases with age in DMD cases

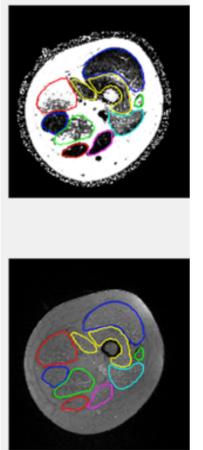
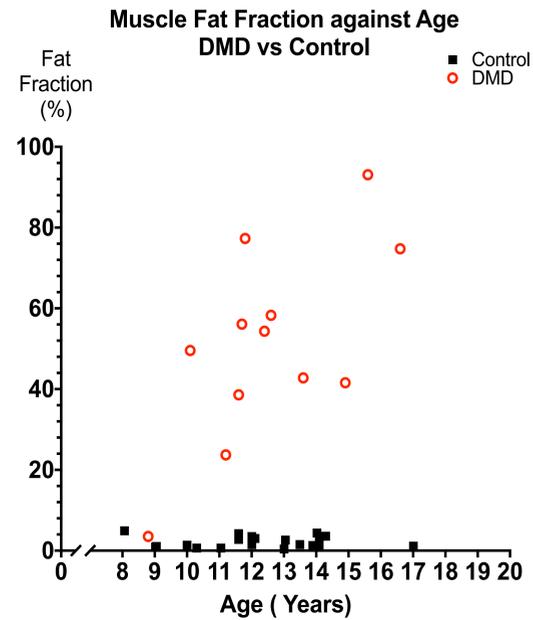


Figure 4: T2-weighted multi-echo spin echo pulse sequence Muscle Inflammation (T2 Tri-exponential model) is significantly increased and Residual Muscle Contractile Area is significantly reduced in DMD cases

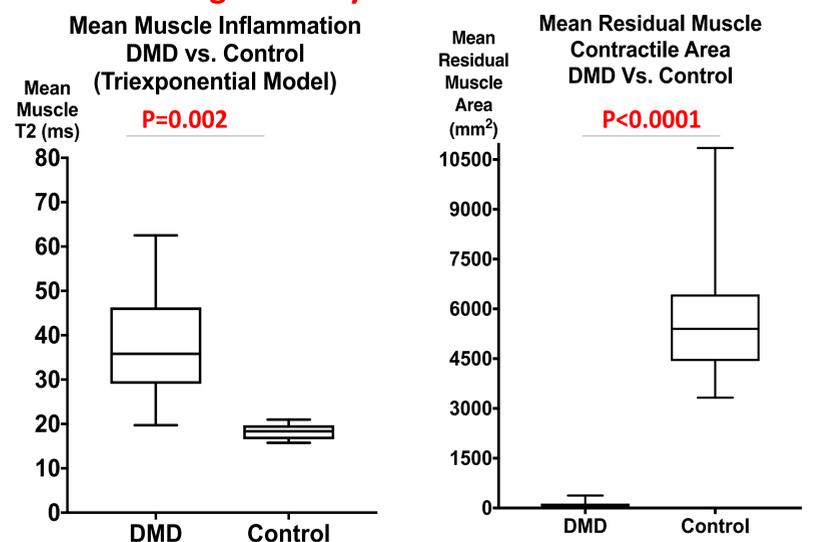
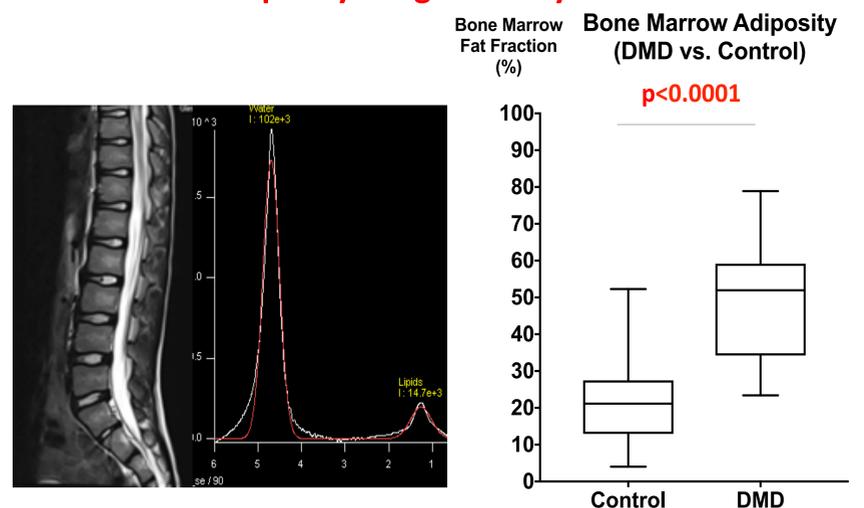


Figure 5: H¹ - MRS was performed using a PRESS pulse sequence Bone Marrow Adiposity is significantly increased in DMD cases



Conclusion

•High resolution MRI provides novel information on multiple components of musculoskeletal health in DMD.

•GC treated boys with DMD have deficits in trabecular microarchitecture, cortical geometry and showed increased bone marrow adiposity.