Editorial for 'Utilisation of multi-parameter quantitative magnetic resonance imaging in the early diagnosis of Duchenne muscular dystrophy'

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MRI techniques have obvious potential as noninvasive disease biomarkers in muscular dystrophy, given their spatial resolution and ability to detect and quantify several aspects of the tissue-level pathophysiology. A paper in this issue (1) examines the diagnostic performance of multi-parametric quantitative muscle MRI (qMRI) in patients with Duchenne muscular dystrophy (DMD), particularly those at an early stage without abnormal fat infiltration or significant physical decline. In a cross-sectional study of 140 boys with DMD (mean age 9 years) compared with 24 similar-aged healthy controls, patients had on average higher T2 and fat fraction (FF), and lower T1, in the 11 thigh muscles examined. In discriminating all patients from controls, FF and T2 performed well, achieving a high area under the curve (AUC) in Receiver Operating Characteristic (ROC) analysis. In a subgroup of 5 younger boys with entirely normal FF, both T1 and T2 were increased, and in discriminating these from controls the combination of T1 and T2 performed well in terms of AUC. Patients were also divided into three functional subgroups defined by North Star Ambulatory Assessment (NSAA) score as mild, moderate and severe impairment. In discriminating the 20 mildly affected patients from controls, T2 performed better than FF or T1. In discriminating the 20 mild from the 43 moderate and 77 severe patients, FF performed best.

The tissue pathophysiology of DMD is complex, but reasonably well understood (2, 3). The earliest pathological features are edema/inflammation (tending to increase T2 and T1), followed by intramuscular fatty infiltration (tending to increase FF and T2, and to decrease T1); thus T2 is increased by both edema/inflammation and fat infiltration, while T1 is increased by the former and decreased by the latter. In late-stage disease fibrosis becomes important: this tends to increase T1, but this is outweighed by the T1-decreasing effect of fat replacement (2, 4).

A strength of this work is the large sample, including early-stage disease. Like any cross-sectional study, insights into disease progression can only be inferential, but the results make pathophysiological sense: T2 and FF were more abnormal than T1, and better discriminators of patients *vs* controls and severe *vs* mild impairment.

The authors conclude that multi-parameter qMRI is effective at distinguishing early-stage DMD patients form controls, even those with only mild physical impairment. However, an important question is the potential clinical utility: the authors frame this in terms of diagnosis, but given the effectiveness of genetic testing for DMD, more promising uses of *in vivo* biomarkers are post-diagnosis, in tracking (5) or predicting (6) disease progress or treatment effectiveness, or as endpoints in therapeutic trials (7, 8). Many MR-based methods are available to study muscle pathology (8, 9), with little consensus on which is best for particular purposes (9). There is therefore much scope for future studies, both cross-sectional like this one (1) and longitudinal (5, 10).

References

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