Quantitative imaging

OP0332

MUSCLE DETERIORATION DUE TO RHEUMATOID ARTHRITIS: ASSESSMENT BY QUANTITATIVE MRI AND STRENGTH TESTING

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Background: As well as joint damage, rheumatoid arthritis (RA) is also associated with altered body composition known as rheumatoid cachexia (RC). RC is characterised by reduced skeletal muscle and increased (white) fat mass and decreased strength. RC is associated with increased disease severity and disability (1). It is unknown at what stage muscle involvement begins in RA, and if the muscle damage is modifiable when patients achieve disease control.

Quantitative MRI (qMRI) can measure the biomarkers associated with RC. MRI T2 is sensitive to fluid related to physiological changes at the molecular level, and is regarded as an indirect measure of muscle inflammation (2). MRI muscle fat fraction (FF) measurements are useful for identifying myosteatosis (3).

Objectives: To obtain preliminary estimates of the extent to which muscle imaging phenotype differs between RA and healthy controls (HC); and to describe the RA phenotype at different levels of disease activity.

Methods: 39 RA patients (comprising three groups) and 13 age and gender directly matched HC had a MRI scan of their dominant thigh. The RA groups were:

- [1] 13 'New RA' - newly diagnosed, treatment naïve
- [2] 13 'Active RA' - diagnosed >1 year, persistent DAS28 >3.2 for >1 year
- [3] 13 'Remission RA' - diagnosed >1 year, persistent DAS28 <2.6 for >1 year

MR images of the mid-thigh were acquired using Dixon imaging to assess FF and a fat-suppressed multi-echo spin-echo to measure T2. Regions of interest were drawn around the quadriceps and hamstrings. All participants had knee extension and flexion torque measured on an isokinetic dynamometer, and isometric dynamometer to measure grip strength. One-Way ANOVA with

Dunnett's post-hoc analysis provided preliminary indication of potential differences between T2, FF, muscle volume and strength measurements between the disease stages.

Results: 39 RA patients were recruited: 13 new RA (mean age [years] 63 ± 15, DAS28 5.2 ± 3), 13 active RA (mean age [years] 65 ± 10, DAS28 4.8 ± 3), 13 remission RA (mean age [years] 67 ± 19, DAS28 1.7 ± 0.7) and also 13 HC. T2 and FF were higher in RA patients compared to HC (fig. 1). Within the hamstrings for T2, the mean differences between HC versus new, active and remission patients were 4.5ms (95% CI 2.5, 6.4; p<0.001), 3ms (95% CI 1.1, 4.9; p=0.001), and 5.0ms (95% CI 3.0, 6.4; p<0.001) respectively. Quadriceps results were similar. For muscle volume, the mean differences between HC versus new, active and remission patients were -517.3cm³ (95% CI -751, -283; p<0.001), -370.5cm³ (95% CI -605, -136; p=0.001), and -312.3cm³ (95% CI -546, -77; p=0.006) respectively (fig. 2). Knee flexion/extension and handgrip strength were lower in all 3 groups of RA patients compared to HC. For knee flexion, the mean differences between HC versus new, active and remission patients were 18.4Nm (95% CI -35, -1; p=0.03), 10.1Nm (95% CI -27, 7; p=0.3), and 13.3Nm (95% CI -33, 0; p=0.1) respectively.

Figure 1. Quantitative T2 and FF MRI of RA patients and healthy controls

Conclusion: This pilot study suggests muscle health may be adversely affected in RA patients compared to matched HC. Our results suggest that muscle changes occur in the earliest stages of RA and persist throughout the disease duration, even in clinical remission. If confirmed, these data imply the need for adjunctive muscle intervention to current RA treatment strategies in order to improve patient outcomes.

References:

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Figure 2. MRI muscle volume in RA patients and healthy controls

Disclosure of Interests: Matt Farrow: None declared, John Biglands: None declared, Steven Tanner: None declared, Elizabeth Hensor: None declared, Maya H Buch Grant/research support from: Pfizer, Roche, and UCB, Consultant of: Pfizer; AbbVie; Eli Lilly; Gilead Sciences, Inc.; Merck-Serono; Sandoz; and Sanofi, Paul Emery Grant/research support from: AbbVie, Bristol-Myers Squibb, Merck Sharp & Dohme, Pfizer, Roche (all paid to employer), Consultant of: AbbVie (consultant, clinical trials, advisor), Bristol-Myers Squibb (consultant, clinical trials, advisor), Lilly (clinical trials, advisor), Merck Sharp & Dohme (consultant, clinical trials, advisor), Novartis (consultant, clinical trials, advisor), Pfizer (consultant, clinical trials, advisor), Roche (consultant, clinical trials, advisor), Samsung (clinical trials, advisor), Sandoz (clinical trials, advisor), UCB (consultant, clinical trials, advisor), Ai Lyn Tan: None declared

DOI: 10.1136/annrheumdis-2020-eular.1348

Description: For each item above, participants were asked to rate their level of knowledge / skills, compared to what is expected in their professional role, using a 5-point scale (1=None, 2=Basic, 3=Intermediate, 4=Advanced, 5=Expert, NR=Not relevant). Data shows percent (%) of those who selected 1, 2 or 3 in each country.

Legend: *Significant differences between countries at p<0.05. PsA=psoriatic arthritis RA=rheumatoid arthritis axSpA= axial spondyloarthritis

Figure 1- Percent of rheumatologists in Germany (n=55), United Kingdom (n=54) and United states (n=64) who reported sub-optimal level of relevant knowledge and skills