Update on the OMERACT Magnetic Resonance Imaging Task Force: Research and Future Directions

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ABSTRACT. Magnetic resonance imaging (MRI) provides an important biomarker across a range of rheumatological diseases. At the Outcome Measures in Rheumatology (OMERACT) 11 meeting, the MRI task force continued its work of developing and improving the use of MRI outcomes for use in clinical trials. The breadth of pathology in the Rheumatoid Arthritis MRI Score has been strengthened with further work on the development of a joint space narrowing score, and a series of exercises presented at OMERACT 11 demonstrated good reliability and construct validity for this assessment. Understanding the importance of residual inflammation after RA treatment remains a major focus of the group's work. Analyses were presented on defining the level of synovitis (using MRI scores of a single hand) that would predict absence of erosion progression. The development of the OMERACT Hand Osteoarthritis MRI score has continued with substantial work presented on its iterative development, including pathology definition, scaling, and subsequent reliability of the score. Optimizing the role of MRI as a robust biomarker and surrogate outcome remains a priority for this group. (J Rheumatol First Release Dec 1 2013; doi:10.3899/jrheum.131085)

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Magnetic resonance imaging (MRI) is maintaining its importance as an outcome measure in clinical trials, both in rheumatoid arthritis (RA) and across a range of rheumatological disease areas. Its importance is based on its ability to objectively assess both inflammation — synovitis, osteitis (precursor of bone erosions in RA), and tenosynovitis — and damage (especially erosions, which it detects with greater sensitivity than conventional radiographs). MRI has

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the capacity to detect inflammation that is not detected on clinical examination, what has been termed "subclinical" synovitis. The need for increased sensitivity to detect differences between 2 active treatment arms is increasingly relevant now, when modern trial designs do not ethically allow long periods of placebo use, and where disease activity levels at time of recruitment are falling[1].

At OMERACT 11, the MRI Task Force presented work across a range of pathologies and disease areas in line with what had been planned following the OMERACT 10 meeting.

Joint Space Narrowing in RA

One of the omissions from the original Rheumatoid Arthritis MRI Score (RAMRIS), a semiquantitative scoring system (the now-accepted gold standard for assessing MR clinical trials) was that of joint space narrowing (JSN) assessment. This was due to the relatively poor quality of images at the time the original score system was developed. Subsequently, a preliminary score system was developed at OMERACT 10[2], and in exercises prior to OMERACT 11, the intrareader and interreader reliability was assessed, with excellent results. Importantly, these scores were also compared with computed tomography (CT), which offers the opportunity to understand the interbone distance in comparable 3-dimensional (3-D) images. Again, a high correlation of MRI with CT scores was demonstrated[3].

Defining an MR-acceptable Disease Activity State in RA

The OMERACT MRI Task Force had previously identified the concept of determining what critical levels of residual inflammation post-RA treatment would predict subsequent structural deterioration, as a key area for further investigation[4]. Through the work of members of the Task Force, a multicenter collection of RA images from patients in low disease activity or remission states were collected[5]. A number of complex analyses were performed to identify cutoff values for synovitis; values above such a level should predict progression of both radiographic erosions and MRI erosions. Preliminary results presented at OMERACT 11 did identify a synovitis score using a single hand (wrist and metacarpophalangeal joints), beyond which further erosion progression was not visible — work is ongoing to validate these levels.

Hand Osteoarthritis MRI Score

With increasing interest in osteoarthritis (OA) and the need to develop effective analgesics and structure modifying therapies, the MRI Task Force had identified OA as an important area for future development. A separate task force at OMERACT 11 examined some of the semiquantitative scoring systems previously developed for hip OA bone marrow lesions. In collaboration with the Hand OA Group, the MRI Task Force started the development of the Hand OA MRI Score (HOAMRIS). Based on the detailed scoring system developed by the Oslo Group[6], the group went through a series of meetings with iterative development of the pathological features evaluated and the scaling of scores, with reliability exercises performed to understand how subsequent iterations performed. Very good reliability was presented for all the large range of pathological features evaluated[7].

Future Research

All the areas examined at OMERACT 11 require ongoing work. In RA, it is now important to understand whether the JSN score is sensitive to change, and longitudinal data sets will need to be evaluated. JSN on 3-D images is of course more complex than scoring from a conventional radiograph, which presents a single image for analysis. Further iterations of the JSN score may focus on particular sites that show more responsiveness to change, so that the scoring system potentially can be reduced in number of sites evaluated, thereby improving its feasibility. Participants at OMERACT 11 also thought that the development and provision of a JSN atlas, either electronically or Web-based, would be useful to improve the utility of the tool.

Understanding the importance of residual imaging-detected inflammation that predicts important clinical outcomes still requires further detailed analysis. In particular, while synovitis levels have been examined in recent exercises, defining the significance of a combined inflammation score (involving osteitis and synovitis) is also important. Understanding the predictor value of a range of cutoff scores (depending on the number of sites evaluated) will also be essential.

In terms of OA, the newly developed HOAMRIS needs to be refined and in particular developed to understand its construct validity (for example, against CT) and its responsiveness. The application of high-field MRI, in particular the now commonly available 3Tesla, may improve image resolution to a stage where other features such as cartilage can be included in the scoring system. Work on this scoring system is ongoing. A major limitation in development may be the availability of suitable datasets, including longitudinal MR-imaged cohorts. Longitudinal datasets are also being sourced by the MRI group for further development of the Psoriatic Arthritis MRI Score[8].

Two new areas were suggested by participants at OMERACT 11 for possible subsequent development by the MRI group. Enthesitis is a common problem in seronegative arthritides, and while some work is under way on the Achilles tendon using MRI, little work is being done on other sites, and the feasibility of research in this area will be investigated. The feet are commonly involved across the spectrum of musculoskeletal disorders. While there have been some attempts to modify RAMRIS for use in studies of feet, particularly forefeet, in RA, no systematic validation

has been carried out. This is also an area for consideration. Optimizing the role of MRI as a robust biomarker and surrogate outcome remains a priority.

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