The OMERACT MRI Inflammatory Arthritis Group: Advances and Future Research Priorities

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ABSTRACT. The OMERACT magnetic resonance imaging (MRI) in inflammatory arthritis group previously developed the rheumatoid arthritis MRI score (RAMRIS) for use in clinical studies, evaluated the use of extremity MRI, and initiated development of a psoriatic arthritis MRI score (PsAMRIS). At OMERACT 9 the group looked at clarifications of applying the RAMRIS, and presented data from a study examining how the contrast agent gadolinium affects RAMRIS outcomes. Much of the group's effort has been aimed at the iterative development of its PsA score, and reported exercises examining this score demonstrated encouraging results, allowing subsequent presentation of a preliminary PsAMRIS. The large amount of data presented were followed by discussions with the wider audience highlighting constructive suggestions for future research priorities, including further feasibility studies, understanding imaging remission, and further improvements to PsAMRIS. (J Rheumatol 2009;36:1803–5; doi:10.3899/jrheum.090349)

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The OMERACT Magnetic Resonance Imaging (MRI) in Inflammatory Arthritis Group has been active since 1998, with highlights of the group's output including: the OMERACT rheumatoid arthritis (RA) MRI score[1] (RAMRIS), which has aided in the acceptance of MRI as an outcome measure in RA clinical trials; the production of the EULAR-OMERACT RA MRI reference image atlas[2], with its focus on bone erosions, bone edema, and synovitis; and examination of the validity and reliability of extremity-MRI in RA[3,4].

Subsequently the group has continued its improvement of the RAMRIS, and some clarification of the scoring system is discussed below. The important issue about whether to use a contrast agent in the assessment of synovitis is presented in an accompanying publication. The group has also spent much time developing a scoring system for peripheral joint pathology in psoriatic arthritis (PsA) using the OMERACT filter[5] and the results of 2 iterative exercises and the subsequent preliminary PsAMRIS definitions will also accompany this overview.

Rheumatoid arthritis imaging issues. Our experience with using this scoring system has indicated the need for clarity

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on scoring bone-related pathology in the severely damaged joints. The RAMRIS grades bone loss due to erosion on a 0–10 scale based on percentage of estimated bone volume loss[1]; this has subsequently been validated against detailed volumetric measures[6,7]. However, it is not unusual in severe RA to see fusion of carpal bones. After fusion it is not possible to discern how much of the original bone volume has been lost, nor to determine subsequent change in bone erosion volume. After due consideration we suggest that any bony site (metacarpophalangeal or wrist bone) with bone fusion be scored as a "10." In a longitudinal study this occurrence means the scoring will suggest progression. However, we recognize that this may very occasionally result in some exaggeration of progression scores. A score of 10 at baseline means it will not be possible to demonstrate a change in score over time, but in our experience this is generally the case with fused bones, as no further change in bone loss is usually discernible. Uncommonly (and this will be recognizable in less damaged joints) there may be congenital fusion of carpal bones, in which case the individual bones should be evaluated according to the original RAMRIS scoring.

The presence of bone fusion will also necessarily affect the bone edema score, as this is based on percentage of original bony site involvement[1]. We therefore recommend that bone edema not be evaluated at sites where bone fusion has occurred. It is still possible to score synovitis in these damaged joints, and therefore bone fusion does not affect the synovitis score or the ability to score synovitis. However, it should be clear from the above discussion that if the aim of a study is to detect change in bone damage (erosion) score, then it would be wise to include subjects without advanced damage as is found in bone fusion.

The group wished to continue its focus on understanding the feasibility of extremity-MRI, and a short presentation updating the MRI literature since OMERACT 9 was presented at the Kananaskis meeting. One of the current major issues concerning the use of MRI in clinical studies is the use of contrast enhancement. Prior to the OMERACT 9 meeting, the group conducted an interreader reliability exercise on MR images obtained with and without the use of intravenous contrast injection, and these data are presented in an accompanying article[8].

The psoriatic arthritis MRI score. The advantages of MRI mean that the use of MRI in clinical trials of other inflammatory arthritides has also grown. As was the case with RA, a number of scoring methods have been described, with limited data on their psychometric properties. The preliminary work on development of a PsAMRIS score for peripheral joints and looking at a range of relevant features (including synovitis, entheseal abnormalities of capsule and bone, bone erosions, and subcutaneous edema) was presented at the OMERACT 8 meeting[9]. Following this, through a series of meetings and scoring exercises, the MRI in inflammatory arthritis group produced further iterative development of the PsAMRIS in terms of domains to be included, scaling of individual item scores, and subsequent interreader reliability. These exercises and preliminary score are presented in 2 accompanying articles[10,11].

SUMMARY AND FUTURE RESEARCH PRIORITIES

A large amount of new data was presented at this OMERACT 9 meeting. The final part of the Special Interest Group (SIG) session involved audience participation in a constructive discussion of the future research agenda for this group. All felt the group should continue in the disease areas already highlighted. In RA, there was discussion of the need to further highlight feasibility, including: the consequences of omitting gadolinium contrast injection, dedicated extremity-MRI units, easier quantification methods (e.g., automated/semiautomated), and on multicenter trial issues (e.g., hand positioning). It was recognized that a number of MRI trials (some large) are currently under way, and some answers may emerge from these datasets. Further, the audience felt that defining criteria for "MRI remission" or "MRI acceptable disease activity state" as a supplement to clinical remission criteria would be an important and valuable goal for the group. It was also mentioned that we should reexamine MRI assessment of joint space narrowing/cartilage loss. Further, improving the understanding of the predictive benefits of MRI (e.g., in terms of future disability and inhibition of erosion progression) was highlighted, especially understanding the role of MRI in early inflammatory arthritis.

In PsA, all recognized the need for further investigation of the current PsAMRIS for hands, including undertaking an exercise on larger data sets, with good range of pathologies and under optimal circumstances (calibration, high-resolution identical monitors, etc.). Further, it was discussed whether to assess if gadolinium contrast can be omitted in PsA, without significant loss of information. Given the diverse clinical presentations of PsA, the need for differentiation from RA scoring, and a focus on other anatomical areas (such as feet and perhaps entheses) was discussed. However, all recognized that there are relatively few PsA MRI datasets available for developing the score in a timely fashion, and the OMERACT MRI group therefore would welcome contact from anyone who could provide PsA MRI datasets for future exercises.

REFERENCES

1. Ostergaard M, Peterfy C, Conaghan P, et al. OMERACT rheumatoid arthritis magnetic resonance imaging studies. Core set of MRI acquisitions, joint pathology definitions, and the OMERACT RA-MRI scoring system. J Rheumatol 2003;30:1385-6.
2. Ostergaard M, Edmonds J, McQueen F, et al. The EULAR-OMERACT rheumatoid arthritis MRI reference image atlas. Ann Rheum Dis 2005;64 Suppl 1:i2-i55.
3. Bird P, Ejbjerg B, Lassere M, et al. A multireader reliability study comparing conventional high-field magnetic resonance imaging

with extremity low-field MRI in rheumatoid arthritis. J Rheumatol 2007;34:854-6.
4. Conaghan PG, Ejbjerg B, Lassere M, et al. A multicenter reliability study of extremity-magnetic resonance imaging in the longitudinal evaluation of rheumatoid arthritis. J Rheumatol 2007;34:857-8.
5. Boers M, Brooks P, Strand CV, Tugwell P. The OMERACT filter for outcome measures in rheumatology. J Rheumatol 1998;25:198-9.
6. Perry D, Stewart N, Benton N, et al. Detection of erosions in the rheumatoid hand; a comparative study of multidetector computerized tomography versus magnetic resonance scanning. J Rheumatol 2005;32:256-67.
7. Dohn UM, Ejbjerg BJ, Hasselquist M, et al. Rheumatoid arthritis bone erosion volumes on CT and MRI: reliability and correlations with erosion scores on CT, MRI and radiography. Ann Rheum Dis 2007;66:1388-92.
8. Ostergaard M, Conaghan PG, O'Connor P, et al. Reducing costs, duration and invasiveness of MRI in RA by omitting intravenous gadolinium injection — does it affect assessments of synovitis, bone erosions and bone edema by the OMERACT RAMRIS? J Rheumatol 2009;36: [in press].
9. McQueen F, Lassere M, Bird P, et al. Developing a magnetic resonance imaging scoring system for peripheral psoriatic arthritis. J Rheumatol 2007;34:859-61.
10. McQueen F, Lassere M, Duer-Jensen A, et al. Testing a magnetic resonance imaging scoring system for peripheral psoriatic arthritis in cross-sectional and longitudinal settings. J Rheumatol 2009;36:1811-5.
11. Ostergaard M, McQueen F, Wiell C, et al. The OMERACT psoriatic arthritis magnetic resonance imaging scoring system (PsAMRIS): definitions of key pathologies, suggested MRI sequences and preliminary scoring system for PsA hands. J Rheumatol 2009;36:1816-24.