

Does adding the presence of MRI detected bone marrow oedema improve the accuracy of the 2010 EULAR/ACR criteria for rheumatoid arthritis?

With great interest we read the letter of Tamai *et al* who studied whether adding information obtained by MRI of wrist and metacarpophalangeal (MCP) joints to the existing 2010 European League against Rheumatism (EULAR)/American College of Rheumatology (ACR) classification criteria for rheumatoid arthritis (RA) was helpful in improving the accuracy of these criteria. The study population was patients with undifferentiated arthritis according to the 1987 classification criteria. Two outcomes were studied: fulfilling the 1987 classification criteria for RA after 1-year of disease and the start of disease-modifying antirheumatic drugs (DMARDs) within the first year.¹ The results on MRI detected bone marrow oedema (BME) added to the 2010 criteria with the start of DMARDs as outcome were most interesting. The sensitivity and specificity of the 2010 criteria without addition of BME were 61.9% and 82.6% respectively and the accuracy 70.5%. After adding information on BME, an increase in sensitivity and accuracy was observed (76.3% and 75.9%, respectively); this was accompanied by a decline in specificity (75.4%). Area under receiver operator characteristic curves (AUCs) were not reported.¹

It is known that the 2010 criteria for RA are fulfilled earlier in time than the 1987 classification criteria and that the 2010 criteria have a higher sensitivity and lower specificity than the 1987 criteria.²⁻⁴ In order to seek for replication of the above mentioned findings, and thus to evaluate whether the addition of MRI findings (BME and erosions) to the 2010 criteria results in an increase in diagnostic accuracy, we performed the analyses as done by Tamai *et al*.

Similar to Tamai and colleagues, we studied patients with undifferentiated arthritis according to the 1987 criteria

(n=205). Patients were included in the Leiden Early Arthritis Clinic between August 2010 and August 2013; all patients had 1-year follow-up.⁵ The mean age was 55 (SD 15) years, 61% were women, the median number of swollen joints (66 swollen joint count) was 3 (IQR 1-5), the median symptom duration was 10.7 (IQR 5.1-24.5) weeks and 22% were anti-citrullinated protein antibody (ACPA) positive. Unilateral MRIs of the MCP and wrist joints were made at inclusion using a 1.5T extremity MRI (General Electric Healthcare). Scanning and scoring were done according to Rheumatoid Arthritis Magnetic Resonance Imaging Scoring System (RAMRIS); all scans were evaluated by an experienced reader (WVN, within reader intraclass correlation coefficient total RAMRIS 0.93).

We used the same two outcomes. In our data, 47 (23%) of the 1987 undifferentiated arthritis (UA) patients fulfilled the 1987 criteria after 1 year and DMARDs were prescribed in 96 patients (47%). The test characteristics when analysing both outcomes are presented in table 1. When fulfilling the 1987 criteria after 1 year was used as outcome, the sensitivity of the 2010 criteria was 53% and the specificity 84%. When adding information on BME (a total score of ≥ 1), the sensitivity increased to 83% and the specificity decreased to 36%. Similar results, an increased sensitivity and decreased specificity, were observed when the start of DMARDs was used as outcome (table 1). The accuracy and AUC remained unchanged when DMARDs start was assessed as outcome (from 65% to 63%, $p=0.67$ and from 0.64 to 0.64, $p=0.93$, respectively) and decreased when fulfilling the 1987 criteria was studied as outcome (from 77% to 47%, $p<0.001$ and from 0.68 to 0.60, $p=0.024$, respectively). When information on MRI detected erosions was added, a similar tendency in the data was observed (table 1). Furthermore, we wondered whether findings would change in case only higher BME or erosion scores were studied. Hence analyses were repeated using scores ≥ 2 as a cut-off for positive MRI findings; this also resulted in similar findings (table 1). It remains elusive to what extent our MRI data and the MRI data

Table 1 Test characteristics of the 2010 EULAR/ACR criteria alone and after addition of information on MRI detected BME or MRI detected erosions for two outcomes (fulfilling the 1987 classification criteria after 1 year or the prescription of DMARDs during the first year) in patients with undifferentiated arthritis according to the 1987 classification criteria for RA

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	LR+	LR-	Accuracy (%)	AUC
<i>A score of at least 1 was used as cut-off</i>								
DMARD start								
2010 RA	40 (33 to 46)	88 (84 to 93)	75 (69 to 80)	62 (56 to 69)	3.32 (1.88 to 5.85)	0.69 (0.58 to 0.82)	65 (59 to 72)	0.64 (0.56 to 0.72)
+BME	83 (78 to 88)	45 (38 to 52)	57 (50 to 64)	75 (69 to 81)	1.51 (1.25 to 1.83)	0.37 (0.23 to 0.61)	63 (56 to 70)	0.64 (0.57 to 0.72)
+ERO	88 (83 to 92)	30 (24 to 37)	53 (46 to 59)	73 (67 to 79)	1.25 (1.09 to 1.45)	0.41 (0.23 to 0.75)	57 (50 to 64)	0.59 (0.51 to 0.67)
1987 criteria positivity								
2010 RA	53 (46 to 60)	84 (78 to 89)	49 (42 to 56)	86 (81 to 91)	3.23 (2.08 to 5.03)	0.56 (0.41 to 0.77)	77 (71 to 82)	0.68 (0.59 to 0.78)
+BME	83 (78 to 88)	36 (30 to 43)	28 (22 to 34)	88 (83 to 92)	1.3 (1.09 to 1.55)	0.47 (0.24 to 0.92)	47 (40 to 54)	0.60 (0.51 to 0.68)
+ERO	87 (83 to 92)	25 (19 to 31)	26 (20 to 32)	87 (82 to 91)	1.16 (1.01 to 1.33)	0.52 (0.23 to 1.15)	39 (32 to 46)	0.56 (0.47 to 0.65)
<i>A score of at least 2 was used as cut-off</i>								
DMARD start								
2010 RA	40 (33 to 46)	88 (84 to 93)	75 (69 to 80)	62 (56 to 69)	3.32 (1.88 to 5.85)	0.69 (0.58 to 0.82)	65 (59 to 72)	0.64 (0.56 to 0.72)
+BME	73 (67 to 79)	58 (51 to 65)	60 (54 to 67)	71 (65 to 77)	1.73 (1.34 to 2.22)	0.47 (0.33 to 0.68)	65 (58 to 71)	0.65 (0.58 to 0.73)
+ERO	73 (67 to 79)	49 (42 to 55)	56 (49 to 62)	67 (61 to 74)	1.42 (1.14 to 1.77)	0.56 (0.38 to 0.82)	60 (53 to 67)	0.61 (0.53 to 0.68)
1987 criteria positivity								
2010 RA	53 (46 to 60)	84 (78 to 89)	49 (42 to 56)	86 (81 to 91)	3.23 (2.08 to 5.03)	0.56 (0.41 to 0.77)	77 (71 to 82)	0.68 (0.59 to 0.78)
+BME	74 (68 to 80)	49 (42 to 56)	30 (24 to 36)	87 (82 to 91)	1.45 (1.16 to 1.82)	0.52 (0.31 to 0.88)	55 (48 to 61)	0.62 (0.53 to 0.7)
+ERO	77 (71 to 82)	43 (36 to 50)	29 (22 to 35)	86 (81 to 91)	1.34 (1.09 to 1.66)	0.54 (0.31 to 0.94)	51 (44 to 58)	0.60 (0.51 to 0.69)

Test characteristics are shown with a 95% CI.

AUC, area under receiver operating characteristics curve; BME, bone marrow oedema; DMARD, disease-modifying antirheumatic drug; ERO, MRI detected erosion; LR-, negative likelihood ratio; LR+, positive likelihood ratio; NPV, negative predictive value; PPV, positive predictive value; RA, rheumatoid arthritis.

of Tamai *et al* are comparable. Tamai *et al* did not provide a definition of presence of BME and erosions; we used two different cut-offs based on RAMRIS. Differences in reading or differences in MRI technique may yield discrepancies and hamper extrapolation of findings.

In conclusion, in line with the findings of Tamai *et al*, we did observe an increase in sensitivity when adding information on MRI detected BME or MRI detected erosions to the 2010 criteria. However, this was at the cost of a considerable decrease in specificity. The accuracy and discriminative ability (expressed using AUCs) decreased or remained unchanged. Based on these results, we conclude that the addition of MRI detected features to the 2010 classification criteria for RA does not evidently improve the accuracy of these criteria when applied in patients with undifferentiated arthritis according to the 1987 criteria.

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