

Systematic Review of the Association between Magnetic Resonance Imaging and Radiographic Detection of Erosions in Rheumatoid Arthritis

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Background

- In rheumatoid arthritis (RA), X-ray erosions are clinically relevant
 - Prognostic of long-term functional disability (1)
 - A primary clinical trial endpoint (2)
- MRI erosions are more prevalent than X-ray erosions (3-6)
 - Resulting from MRI multi-sectional & multi-planar features
 - Specificity of MRI erosions for RA is uncertain
- Disparities between MRI & X-ray require reconciliation
- Hypothesis:**
 - Early MRI erosions progress and later detected on X-ray
 - Relative diagnostic test properties temporally dependent

Objectives

- To compare the relative diagnostic test accuracy of X-ray for MRI-detected erosions; and
- To determine if MRI erosions develop into X-ray erosions over time.

Methods

- Literature search indexes
 - Medline (Jan 1996-Apr 2011)
 - EMBASE (Jan 1998-Apr 2011)
- PICO search strategy using Medical Subject Heading terms:

P exp Arthritis, Rheumatoid/ or exp Arthritis, Psoriatic/ or exp Spondylitis, Ankylosing/ or exp Arthritis, Reactive/ or exp Arthritis/ or (arthritis or oligoarthritis or polyarthritis or monoarthritis or ankylosing spondylitis or rheum\$).mp.

I exp Radiography/ or exp X-Rays/ or radiography.mp. or x-ray.mp.

C exp Magnetic Resonance Imaging/ exp Magnetic Resonance Spectroscopy/ or (magnetic resonance imaging or nuclear magnetic resonance).mp.

O (exp "Bone and Bones"/ or (bone or erosi\$ or damage or destruct\$).mp.) and (exp Joints/ or exp Tarsal Joints/ or exp Carpometacarpal Joints/ or exp Hand Joints/ or exp Carpal Joints/ or exp Foot Joints/ or exp Sternoostal Joints/ or joints).mp.)
- Eligibility criteria**
 - Inclusion criteria**
 - RA; X-ray; MRI; erosion outcome; paired comparison; joint or more precise unit of analysis
 - Exclusion criteria**
 - Replicate cohort data; Insufficient data

Literature Selection and Appraisal

- 2 independent reviewers screened titles, abstracts & full articles disagreements arbitrated by a 3rd reviewer
- Study quality evaluated using Quality Assessment of Diagnostic Accuracy Studies (QUADAS) (7)

Analysis

- Diagnostic test properties analyzed by symptom duration and time between MRI & X-ray

Software: Wolters Kluwer OVID SP; Refworks; Cochrane Collaboration Review Manager

Results

- Literature search flow diagram (Fig. 1)

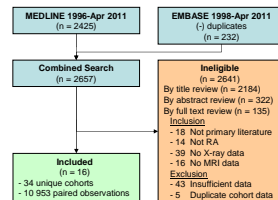


Fig. 1. Literature selection flow diagram

- Study Characteristics (6-21)

- Studies varied by symptom duration, magnetic strength, erosion definition, # of X-ray projections, use of scoring system, # of raters, unit of analysis, anatomy compared (Fig. 2), methodological quality (Fig. 3).

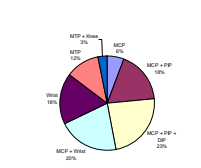


Fig. 2. Anatomy compared

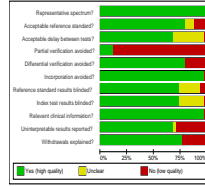


Fig. 3. QUADAS assessment

Overall Results

- Relative diagnostic test accuracy results heterogeneous
 - Sensitivity (95% CI): 0.00 (0.00-0.04) to 0.87 (0.60-0.98)
 - Specificity: 0.38 (0.14-0.68) to 1.00 (0.99-1.00)
- Weighted by study sample size
 - Sensitivity, 0.28 (0.28-0.29); specificity, 0.97 (0.97-0.97)

Inter-cohort results by symptom duration*

- Sensitivity: 0.07 (0.01-0.24), 0.25y to 0.34 (0.20-0.51), 14y
- Specificity: 0.99 (0.97-1.00), 0.25y to 0.92 (0.88-0.95) 9.5y
- *Studies excluded from summary findings
- Extreme values omitted from summary ranges reported (sensitivity (7,21); specificity (20))
- Study excluded from tabulated summary (Fig. 4)
 - Symptom duration not reported (8,15)
 - Unique, limited anatomy investigated (13,14)

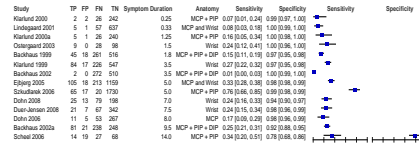


Fig. 4. Inter-cohort results by symptom duration.

Intra-cohort results by symptom duration & time between initial MRI & follow-up X-ray

- Across 4 longitudinal cohorts: sensitivity increased & specificity decreased with time

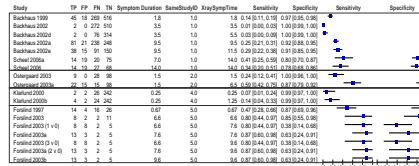


Fig. 5. Intra-cohort results by symptom duration and time between initial MRI & follow-up X-ray (XraySympTime). Individual cohorts differentiated by black borders.

Conclusions

- X-ray has low sensitivity and high specificity for MRI erosions
- X-ray & MRI relative diagnostic test properties for erosion depend on symptom duration and time between imaging
 - As symptom duration increases,
 - X-ray sensitivity for MRI erosions increases
 - X-ray specificity for MRI erosions decreases
 - As the time between MRI and X-ray imaging increases,
 - X-ray sensitivity for MRI erosions increases
 - X-ray specificity for MRI erosions decreases
- X-ray erosions occur in joints initially unaffected on MRI
- Study heterogeneity & bias warrant attention in future studies

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