Study Protocol Systematic Review

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Diagnostic accuracy of digital X-ray radiogrammetry on hand bone loss for patients with rheumatoid arthritis

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Abstract

Background: This study will aim to evaluate the diagnostic accuracy of digital X-ray radiogrammetry (DXR) on hand bone loss (HBL) for rheumatoid arthritis (RA).

Methods: In this study, we will search the literature from PubMed, EMBASE, Cochrane Library, PsycINFO, Web of Science, Google Scholar, Cumulative Index to Nursing and Allied Health Literature, Allied and Complementary Medicine Database, Chinese Biomedical Literature Database, China National Knowledge Infrastructure, and WANFANG from the inception to June 1, 2019 without language restrictions. All case–controlled studies on assessing diagnostic accuracy of DXR on HBL for diagnosis of RA will be included. Quality Assessment of Diagnostic Accuracy Studies tool will be used for eligible studies. We will apply RevMan V.5.3 software and Stata V.12.0 software for statistical analysis.

Results: We will evaluate diagnostic accuracy of DXR on HBL in patients with RA by assessing the sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and diagnostic odds ratio.

Conclusion: This study will detect the diagnostic accuracy of DXR evaluation on HBL in patients with RA.

Systematic review registration: PROSPERO CRD42019139489.

Abbreviations: DXR = digital X-ray radiogrammetry, HBL = hand bone loss, PRISMA-P = Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocol, RA = rheumatoid arthritis.

Keywords: digital X-ray radiogrammetry, hand bone loss, rheumatoid arthritis, sensitivity, specificity

1. Introduction

Rheumatoid arthritis (RA) is a chronic, autoimmune, systemic, and inflammatory disease.[1,2] It has been estimated that such disorder affects about 0.5% to 1.0% of the adults,[3,4] and about 5 to 50 new cases per 100,000 persons each year.[3] It often occurs more in females than males with a ratio of 3:1.[5] Such disorder is very common and often affects small joints of the hands and feet.[6–9] Of those, hand bone loss (HBL) is often associated with progressive joint destruction of RA.[10,11] Thus, it may predict the severity and progression of patients with RA.

Digital X-ray radiogrammetry (DXR) is a technique that has been important role in diagnosis of HBL in patients with RA.[11,12–15] In addition, previous clinical studies have reported the diagnostic accuracy of DXR on HBL in patients with RA.[11,16–18] However, no study has explored its diagnostic accuracy on HBL in patients with RA based on the evidence-based medicine levels. Thus, this study will systematically investigate the diagnostic accuracy of DXR on HBL in patients with RA.

2. Methods

2.1. Study protocol registration

This study has been registered via PROSPERO CRD42019139489. It has been carried out to follow the guideline of Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocol (PRISMA-P) statement.[19]

2.2. Eligibility criteria for study selection

2.2.1. Type of studies. We will include case–controlled studies reporting the diagnostic accuracy of DXR on HBL in patients with RA.

2.2.2. Type of participants. In this study, reporting on individuals with RA will be included without restrictions of race, gender, and age.

2.2.3. Type of index test. Index test: DXR evaluation on HBL will be used to diagnose patients with RA. However, we will exclude patients who received both DXR and other tests.

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The authors have no conflicts of interest to disclose.

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Reference test: patients with standard diagnosis of American College of Rheumatology or European League Against Rheumatism, or guideline of Chinese rheumatoid arthritis treatment will be included.

2.2.4. Type of outcome measurements. In this study, we will use sensitivity and specificity as primary outcome measurements. We will utilize positive likelihood ratio, negative likelihood ratio, and diagnostic odds ratio as secondary outcome measurements.

2.3. Literature records selection

2.3.1. Electronic searches. PubMed, EMBASE, Cochrane Library, PsycINFO, Web of Science, Google Scholar, Cumulative Index to Nursing and Allied Health Literature, Allied and Complementary Medicine Database, Chinese Biomedical Literature Database, China National Knowledge Infrastructure, and WANFANG databases will be used to search a comprehensive relevant record from the inception to June 1, 2019 without language restrictions. A comprehensive literature search strategy for PubMed is presented in Table 1. We will also adapt similar literature search strategy for other electronic databases.

2.3.2. Other resources. Grey literature will also be searched, such as conference proceedings, dissertations, and reference list of relevant reviews.

2.4. Data collection and analysis

2.4.1. Selection of studies. Two reviewers will independently select titles and abstracts firstly based on the previously defined eligibility criteria. Any differences between 2 reviewers will be solved. All irrelevant studies will be excluded after initial selection. Then, all rest papers will be recorded to check if they meet final eligibility criteria. We will present the results of study selection in PRISMA flowchart in Figure 1.

Table 1

Search strategy used in PubMed database.

Number	Search terms
1	Rheumatoid arthritis
2	RA
3	Joint stiffness
4	Joint pain
5	Morning stiffness
6	Joint swelling
7	Or 1–6
8	Hand bone loss
9	Bone densitometry
10	Bone mineral density
11	Or 8–10
12	Digital X-ray radiogrammetry
13	X-ray imaging
14	X-ray examination
15	DXR
16	Or 12–15
17	Case–control study
18	Controlled study
19	Case study
20	Clinical study
21	Or 17–20
22	7 and 11 and 16 and 21

DXR = digital X-ray radiogrammetry, RA = rheumatoid arthritis.

2.4.2. Data collection. Two reviewers will independently collect the data using predefined data extraction sheet. Any disagreements will be resolved by discussion with the help of a third reviewer. The data collection consist of title, authors, publication date, location, study design, sample size, index test, reference test, sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and funding information.

2.4.3. Dealing with missing data. We plan to inquire the data from the authors of primary studies if they are missing and insufficient. We will only analyze available data if that data is not achievable.

2.5. Methodological quality assessment

We will use Quality Assessment of Diagnostic Accuracy Studies tool to check methodological quality assessment.[20] Two reviewers will independently evaluate the methodological quality for each eligible study. Any disagreements regarding methodological quality evaluation will be solved by discussion with a third reviewer.

2.6. Statistical analysis

We will apply RevMan V5.3 and Stata V.12.0 softwares (London, UK) for statistical analysis. We will calculate descriptive statistics and 95% confidence intervals for each primary study. We will calculate the pooled sensitivity, specificity, positive likelihood ratio, negative likelihood ratio, and diagnostic odds ratio. We will derive descriptive forest plot and a summary receiver operating characteristic plot will be carried out.

2.6.1. Assessment of heterogeneity. We will assess heterogeneity using I^2 statistic. $I^2 \leq 50\%$ indicates low heterogeneity, while $I^2 > 50\%$ indicates significant heterogeneity.

2.6.2. Data synthesis. We will conduct meta-analysis if heterogeneity is low ($I^2 \leq 50\%$). Otherwise, we will carry out subgroup analysis, and meta-analysis will be performed based on the results of subgroup analysis if heterogeneity is significant ($I^2 > 50\%$). If there is still substantial heterogeneity after subgroup analysis, meta-analysis will not be carried out. Then, we will use bivariate random-effects regression approach to estimate sensitivity and specificity.

2.6.3. Subgroup analysis. Subgroup analysis will be performed to check possible factors that may lead to the significant heterogeneity according to the different characteristics, treatments, and comparators.

2.6.4. Sensitivity analysis. Sensitivity analysis will be carried out by removing low methodological quality studies.

2.6.5. Reporting bias. We will conduct funnel plots to investigate the possible reporting biases among included studies.[21]

2.7. Ethics and dissemination

We will not inquire individual patient data, thus no research ethic approval is needed. We expect to publish results of this study at peer-reviewed journals.

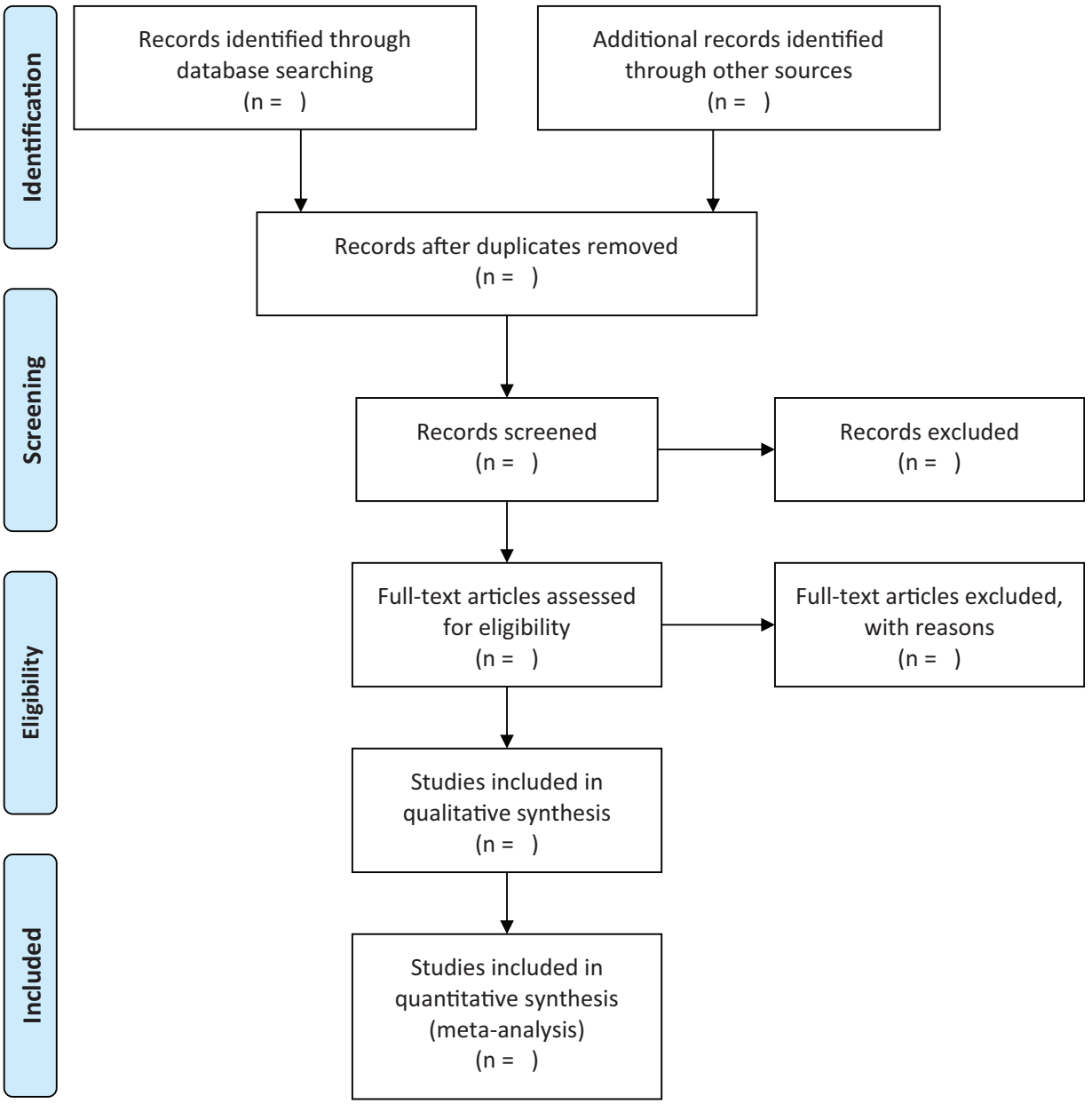

Figure 1. Flow diagram of study selection process.

3. Discussion

Previous studies have reported that DXR can be used to predict and diagnosis HBL for patients with RA.[11,16–18] However, diagnostic accuracy of DXR on HBL in patients with RA still fails to support on the levels of evidence-based medicine. Thus, this study will systematically investigate the diagnostic accuracy of DXR on HBL in patients with RA. The results of this study will provide a summary of the up-to-date evidence on the diagnostic accuracy of DXR on HBL in patients with RA on evidence-based medicine levels. It will also help to predict patients with RA at early stage.

Author contributions

Conceptualization: Hong-Jian An, Jun Zhang.
Data curation: Hong-Jian An, Jun Zhang.
Formal analysis: Hong-Jian An.
Funding acquisition: Jun Zhang.
Investigation: Jun Zhang.
Methodology: Hong-Jian An.
Project administration: Jun Zhang.
Resources: Hong-Jian An.
Software: Hong-Jian An.
Supervision: Jun Zhang.
Validation: Hong-Jian An, Jun Zhang.
Visualization: Hong-Jian An, Jun Zhang.
Writing – original draft: Hong-Jian An, Jun Zhang.
Writing – review & editing: Hong-Jian An, Jun Zhang.

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