

# Imaging Modalities for the Diagnosis and Disease Activity Assessment of Takayasu Arteritis: A Systematic Review and Meta-Analysis

Tahir Kanji<sup>1</sup>, MD, Jacqueline Malette<sup>1</sup>, MD, Christian Pagnoux<sup>2</sup>, MD, Lillian Barra<sup>1</sup>, MD and CanVasc

The University of Western Ontario, The University of Toronto



## Background

- Takayasu's arteritis (TAK) is a rare large vessel vasculitis predominantly affecting young women
- Early detection of disease activity may reduce the risk of vascular complications
- Various imaging modalities may assist clinicians in assessing disease activity

## Objective

Our objective was to determine the effectiveness of imaging modalities in patients with suspected or diagnosed TAK for early diagnosis and accurate disease activity assessment

## Methods

- We searched MEDLINE and EMBASE databases
- Inclusion criteria:** studies reporting on the test performance of various imaging modalities in TAK (diagnosis by physician or classification criteria)
- Exclusion criteria:** case reports, case series with < 5 patients and reviews
- Two authors independently screened articles, assessed risk of bias, reviewed references for additional studies (hand search) and extracted data
- Studies were of the following imaging modalities: sonography, magnetic resonance angiography (MRA), computed tomography angiography (CTA) and fluorodeoxyglucose-positron emission tomography (FDG-PET)
- A random effects model with inverse-variance weighting was performed to determine sensitivity and specificity of imaging modalities for the diagnosis and assessment of disease activity in TAK

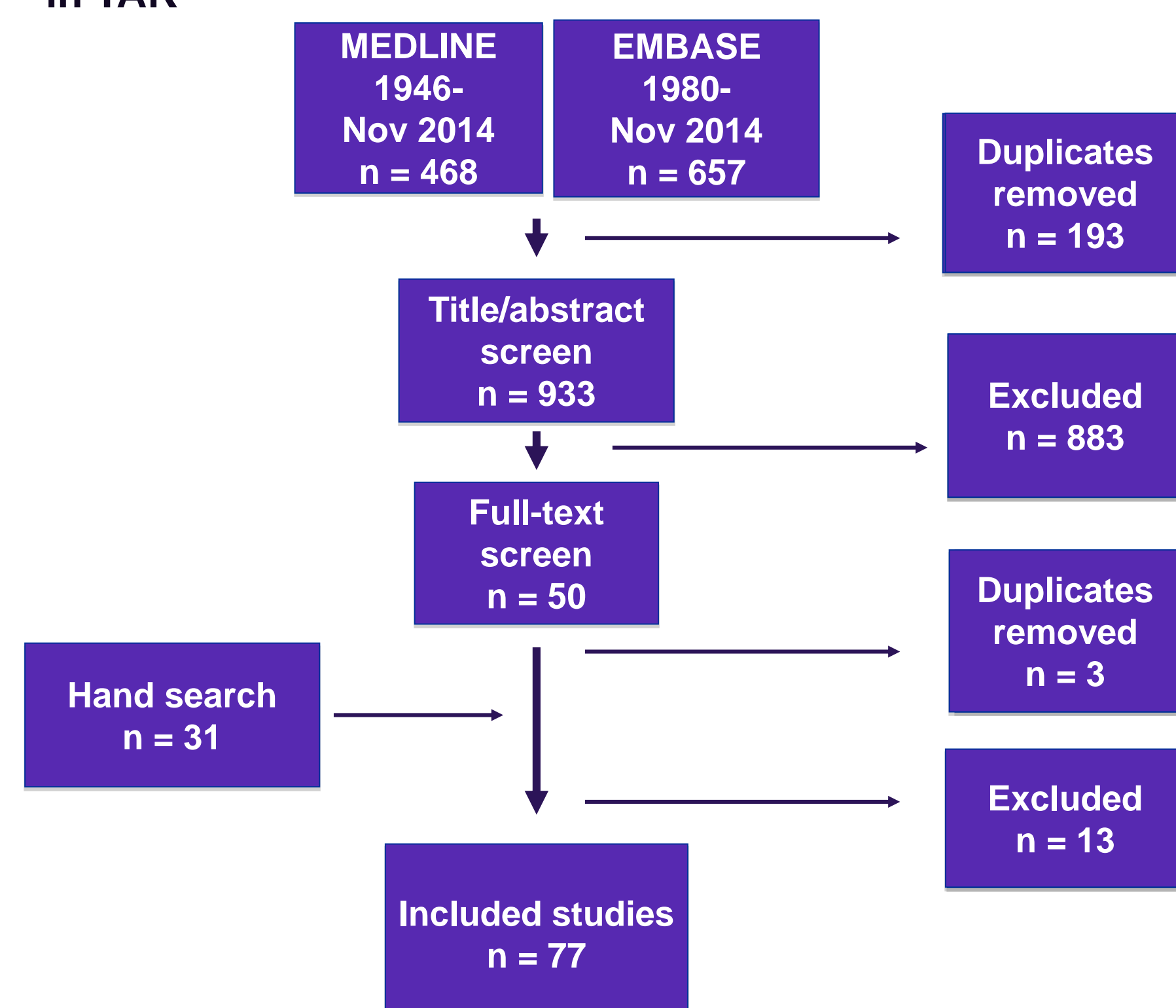


Figure 1. Search Results

## Results

Table 1. Studies of Sonography for Diagnosis of TAK Compared to Clinical Diagnosis

Characteristics of Studies	
Publication Year, range	1991-2006
Study Design, N of studies	
Cross-sectional	4
Sample Size, N	32-125
% Female, range	51-100
Mean age in years, range	35-46
Pooled Specificity (95% CI), I <sup>2</sup>	1.0 (0.98-1.00), 0%
Pooled Sensitivity (95% CI), I <sup>2</sup>	0.83 (0.73-0.90), 0%

Figure 2. Meta-Analysis of Sonography Studies for Diagnosis of TAK

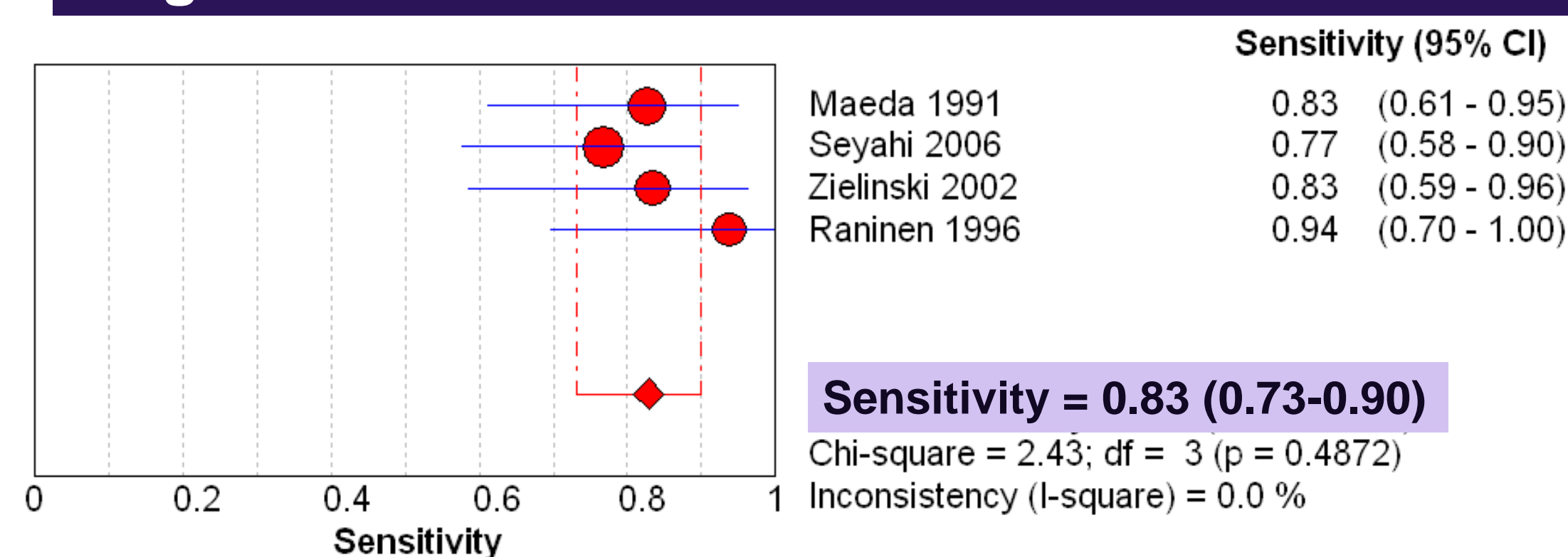


Table 2. Studies of MRA and CTA for Diagnosis of TAK Compared to Conventional Angiography

Characteristics of Studies	
Publication Year, range	1997-2011
Study Design, N of studies	
Cross-sectional	1
Prospective	4
Sample Size, N	10-30
% Female, range	73-100
Mean age in years, range	25-44
CTA Test Performance (N=2 Studies)	
Pooled Specificity (95% CI), I <sup>2</sup>	0.96 (0.92-0.98), 0%
Pooled Sensitivity (95% CI), I <sup>2</sup>	0.85 (0.77-0.91), 85%
MRA Test Performance (N=3 Studies)	
Pooled Specificity (95% CI), I <sup>2</sup>	0.93 (0.90-0.95), 89%
Pooled Sensitivity (95% CI), I <sup>2</sup>	0.95 (0.92-0.90), 76%

- Few studies of imaging modalities for TAK diagnosis with standard comparator
- Studies examined populations with established TAK
- There were no studies that included patients with suspected TAK
- MRA was highly sensitive for TAK
- Sonography and CTA was moderately sensitive for TAK diagnosis

Table 3. Studies of CTA and MRA for Identifying Disease Activity in TAK Compared to Clinical Assessment

Characteristics of Studies	
Publication Year, range	1995-2012
Study Design, N of studies	
Prospective	3
Retrospective	2
Sample Size, N	10-24
% Female, range	78-100
Mean age in years, range	28-38
CTA Test Performance (N=2 Studies)	
Pooled Sensitivity (95% CI), I <sup>2</sup>	0.48 (0.09-0.70), 0%
Pooled Specificity (95% CI), I <sup>2</sup>	1.00 (0.48-1.00), 0%
MRA Test Performance (N= 3 Studies)	
Pooled Sensitivity (95% CI), I <sup>2</sup>	0.72 (0.58-0.83), 92%
Pooled Specificity (95% CI), I <sup>2</sup>	0.49 (0.38-0.51), 83%

- The role of CTA and MRA for assessing disease activity remains unclear as there are few studies and these have variable results
- CTA has high radiation exposure, which is not optimal for monitoring disease activity
- There is no gold standard for comparison

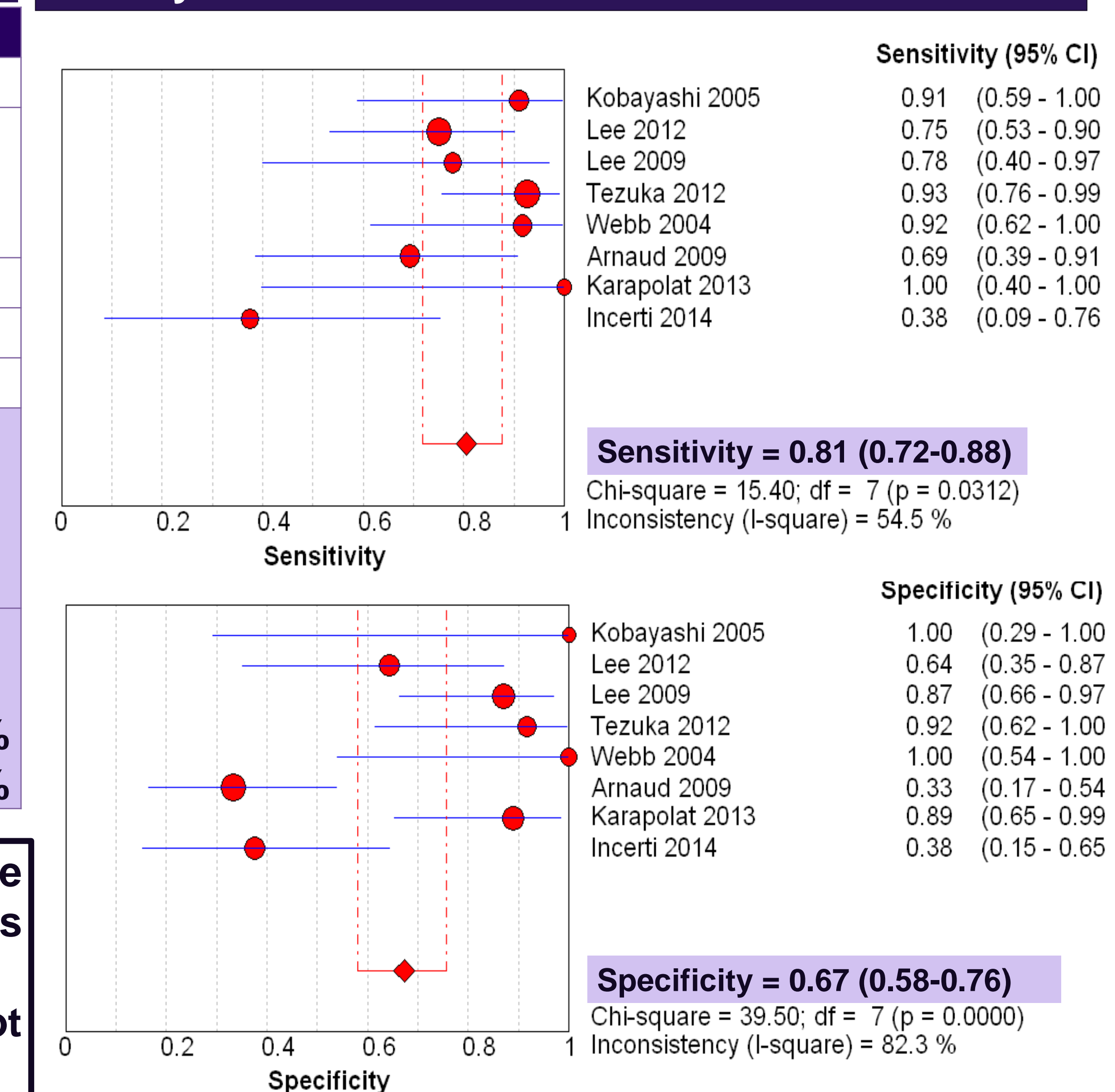
Table 4. Studies of PET for Identifying Disease Activity in TAK Compared to Clinical Assessment

Characteristics of Studies	
Publication Year, range	2004-2014
Study Design, N of studies	
Prospective	2
Retrospective	6
Sample Size, N	18-79
% Female, range	75-94
Mean age in years, range	28-45
Pooled Specificity (95% CI), I <sup>2</sup>	0.67 (0.58-0.76), 82%
Pooled Sensitivity (95% CI), I <sup>2</sup>	0.81 (0.72-0.88), 55%

## Limitations

- Studies were small, cross-sectional, single centre studies, and subject to bias
- Inconsistent definitions for imaging and clinical indices of activity were a source of heterogeneity
- The gold standard for assessing disease activity is undefined

Figure 3. Meta-Analysis of Positron Emission Tomography (PET) Studies for Assessing Disease Activity in TAK



- PET showed moderate sensitivity and poor specificity
- Methodologies and comparators were variable

## Conclusions

- All studies examining the utility of imaging for diagnosis of TAK were of patients with a clinical diagnosis of TAK
- MRA was highly sensitive and sonography and CTA were moderately sensitive for TAK diagnosis
- The role of imaging modalities in assessing disease activity in TAK remains unclear: PET and MRA are neither sensitive nor specific, but more studies of MRA are needed
- The rarity of TAK and lack of standardized measures of disease activity make these studies challenging
- New imaging modalities, such as combination PET with CT or MRA may be better options for assessing disease activity

Acknowledgements:

