INPLASY

Cardiac MRI in Drug-Induced Cardiotoxicity: An Independent Systematic Review and Updated Meta-Analysis of T1 Mapping, ECV Fraction, Late Gadolinium Enhancement, Feature-Tracking Strain, and ICI Myocarditis Diagnostic Performance from January 2000 Through May 2026

INPLASY202660045
doi: 10.37766/inplasy2026.6.0045
Received: 8 June 2026
Published: 9 June 2026

Alanazi, AS; Alanazi, BA.

Corresponding author:
Abdulrahman S. Alanazi

aas2@hotmail.com

Author Affiliation:
Department of Clinical Pharmacy, College of Pharmacy, University of Hail, Hail 81411, Saudi Arabia.

ADMINISTRATIVE INFORMATION

Support - Self-funded. University of Hail College of Pharmacy academic resources. No pharmaceutical industry or commercial funding received.

Review Stage at time of this submission - The review has not yet started.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202660045

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 9 June 2026 and was last updated on 9 June 2026.

INTRODUCTION

Review question / Objective What is the pooled T1 mapping SMD in anthracycline-treated patients versus baseline and controls, does ECV fraction predict CTRCD, and what is CMR sensitivity for ICI myocarditis versus troponin and ECG?

Rationale This systematic review addresses a critical evidence gap in radiological pharmacovigilance. No comprehensive synthesis with pre-specified pattern analyses exists for this topic. Prospective registration ensures transparency and minimises reporting bias.

Condition being studied Drug-induced cardiotoxicity and cancer therapy-related cardiac dysfunction (CTRCD) from anthracyclines, trastuzumab, immune checkpoint inhibitors, and other cardiotoxic oncological agents.

METHODS

Search strategy PubMed/MEDLINE, Embase, Cochrane CENTRAL, Web of Science, and Scopus from January 1, 2000 to May 31, 2026. ClinicalTrials.gov and WHO-ICTRP on May 31, 2026. Key terms: cardiac MRI, CMR, T1 mapping, ECV, extracellular volume, LGE, late gadolinium enhancement, feature-tracking strain, CTRCD, cancer therapy-related cardiac dysfunction, ICI myocarditis, checkpoint inhibitor myocarditis, anthracycline cardiotoxicity, trastuzumab, Lake Louise criteria.

Participant or population Adults aged 18 years or above receiving cardiotoxic oncological agents (anthracyclines, trastuzumab, pertuzumab, ICIs, cardiotoxic TKIs, 5-FU, high-dose cyclophosphamide) with CMR before, during, or after treatment, or with confirmed drug-induced cardiomyopathy or ICI myocarditis.

Intervention Cardiac MRI with native T1 mapping, T2 mapping, extracellular volume fraction (ECV), late gadolinium enhancement (LGE), and feature-tracking global longitudinal strain for cardiotoxicity detection and monitoring.

Comparator Echocardiographic LVEF monitoring as standard clinical comparator; troponin I or T and ECG for ICI myocarditis diagnostic comparison; healthy age-matched controls for CMR parameter reference range comparison.

Study designs to be included RCT CMR substudies; prospective cohort studies (n≥20); retrospective cohort studies (n≥20); ICI myocarditis registries (n≥10 confirmed cases with CMR).

Eligibility criteria Inclusion: Adults receiving cardiotoxic oncological agents with CMR data; confirmed ICI myocarditis with CMR, troponin, and ECG data; CTRCD defined per universal heart failure definition or CARDIOTOX criteria.Exclusion: Paediatric populations; pre-existing cardiomyopathy without drug attribution; studies without extractable CMR quantitative data; case reports (n<10).

Information sources PubMed/MEDLINE, Embase, Cochrane CENTRAL, Web of Science, Scopus, ClinicalTrials.gov, WHO-ICTRP.

Main outcome(s) T1 mapping SMD versus pre-treatment baseline (I^2) and versus healthy controls; ECV fraction OR for predicting CTRCD at ECV threshold; CMR sensitivity and specificity for confirmed ICI myocarditis; minimum detectable LVEF change CMR versus echocardiography.

Additional outcome(s) ECV temporal trajectory during anthracycline treatment; T2 mapping elevation at 6 and 12 weeks; feature-tracking GLS reduction preceding LVEF decline; 5-year survivor ECV and GLS prevalence versus controls; LGE prevalence and distribution.

Data management Data will be managed using Covidence for screening and Rayyan for deduplication. Extracted data stored in pre-piloted Excel forms. Two reviewers screen and extract independently; disagreements resolved by consensus.

Quality assessment / Risk of bias analysis Diagnostic accuracy studies: QUADAS-2 (four domains: patient selection, index test, reference standard, flow and timing). Cohort studies: Newcastle-Ottawa Scale (threshold ≥5 stars). Overall certainty of evidence rated using GRADE per primary outcome.

Strategy of data synthesis Freeman-Tukey double arcsine transformation for proportions under DerSimonian-Laird random-effects model. Bivariate random-effects modelling for diagnostic accuracy (Reitsma method) generating summary ROC curves. Heterogeneity quantified by Cochran Q and I^2. Egger regression and funnel plot inspection for publication bias where ≥10 studies contribute. SMDs for continuous CMR parameters by random-effects inverse-variance weighting. Bivariate random-effects for ICI myocarditis diagnostic accuracy. Prognostic ORs for ECV prediction of CTRCD by DerSimonian-Laird.

Subgroup analysis Drug class (anthracyclines vs trastuzumab vs ICI vs TKI); cumulative anthracycline dose; CMR field strength (1.5T vs 3.0T); study era (pre-2015 vs 2015 onwards); ECV threshold level.

Sensitivity analysis Restriction to prospective cohort studies only; restriction to 3.0T CMR; exclusion of retrospective ICI myocarditis series; restriction to CARDIOTOX-defined CTRCD.

Language restriction No language restriction.

Country(ies) involved Saudi Arabia.

Other relevant information Cardiovascular Imaging; Cardio-Oncology; Clinical Pharmacy; Nuclear Cardiology; Pharmacovigilance.

Keywords cardiac MRI; CMR; T1 mapping; ECV; LGE; CTRCD; ICI myocarditis; anthracycline cardiotoxicity; feature-tracking strain; trastuzumab; systematic review; meta-analysis.

Dissemination plans Peer-reviewed publication in a high-impact radiology, nuclear medicine, or clinical pharmacology journal; open-access preferred.

Contributions of each author

Author 1 - Abdulrahman Alanazi - Conceived and designed the study, drafted the protocol, will lead data extraction and synthesis, and drafted the manuscript and final manuscript submission.
Email: aas2@hotmail.com
Author 2 - Basmah Alanazi - Contributed to the development of the selection criteria, will assist with data extraction and risk of bias assessment, and validity.
Email: drbasmah7@gmail.com