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Cardiac MRI and CT in Infectious and Tropical Heart Diseases in LMICs: A Scoping Review Protocol

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We use this protocol and it's working

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Abstract

Introduction:

Cardiovascular disease remains the leading global cause of mortality, disproportionately affecting low- and middle-income countries (LMICs), where infectious and tropical diseases further compound the burden. Despite the diagnostic value of cardiac magnetic resonance imaging (MRI) and computed tomography (CT) in identifying inflammatory and infectious cardiac conditions, LMICs face major barriers in accessing these modalities, including limited infrastructure and trained personnel. Early and accurate imaging is essential for improving outcomes in these populations.

Purpose:

This scoping review aims to map and synthesize current evidence on the use of cardiac MRI and CT in the evaluation of infectious and tropical heart diseases in low- and middle-income countries (LMICs). It focuses on imaging utilization patterns, disease-specific imaging features, scanner types and sequences used, and the infrastructural context of healthcare systems in LMICs.

Methods:

Following Arksey and O'Malley's scoping review framework, enhanced by Levac et al., and reported in accordance with PRISMA-ScR guidelines, we included observational studies involving adult patients with infectious or tropical cardiac diseases imaged using cardiac MRI or CT in LMICs. A comprehensive database search will support thematic analysis of included literature.

Guidelines

PRISMA Extension for Scoping Reviews (PRISMA-ScR) Checklist.

Arksey and O'Malley Scoping Review Framework.

PRESS (Peer Review of Electronic Search Strategies) guidelines.

Materials

Computers, Internet Connection, MS Word, MS Excel, Reference Manager (Mendeley/EndNote/Zotero), Covidence.

Objectives

- 1 Map the use of cardiac MRI and CT in the evaluation of infectious and tropical cardiac diseases in LMICs, with emphasis on imaging practices and disease-specific applications.
 - 1.1 Identify the range, type, and imaging features of cardiac infections studied using advanced imaging, including myocarditis, endocarditis, pericarditis, Chagas disease, etc.
 - 1.2 Describe scanner specifications, modality use (MRI/CT/PET-CT), and sequence groups (e.g., LGE, T2W, mapping) commonly reported across studies.
 - 1.3 Characterize diagnostic criteria and radiologic patterns described for different disease categories.

Methodology

- 2 Follow the methodological framework established by Arksey and O'Malley, incorporating enhancements recommended by Levac et al.
- 3 Adhere to the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and MetaAnalyses Extension for Scoping Reviews) guidelines.
- 4 Develop and register the protocol on protocols.io.

Stage 1: Identify the research questions

- 5 Primary Research Question:
 - 5.1 How are cardiac MRI and CT utilized in the evaluation of infectious and tropical heart diseases in LMICs?
- 6 Secondary Research Questions:

- 6.1 What infectious or tropical cardiac conditions are most commonly assessed using MRI or CT in LMICs?
- 6.2 What are the common imaging appearances on CT and MRI for different tropical and infectious cardiac diseases?
- 6.3 What healthcare settings (e.g., public, private, tertiary) are involved in providing advanced cardiac imaging in LMICs?
- 6.4 What are the most commonly reported scanner types, sequences, and technical specifications used for cardiac MRI or CT in LMICs?
- 6.5 What diagnostic criteria or imaging findings are used to identify cardiac involvement in these infections?

Identify relevant studies

- 7 Databases: PubMed, Scopus, ScienceDirect, and Google Scholar.
- 7.1 Create the search strategy using a combination of keywords and Medical Subject Headings (MeSH), identified through the MeSH database on PubMed.
- 7.2 **Search strategy for pubmed:**
(((Afghanistan OR Albania OR Algeria OR Angola OR Argentina OR Armenia OR Azerbaijan OR Bangladesh OR Belarus OR Belize OR Benin OR Bhutan OR Bolivia OR Bosnia and Herzegovina OR Botswana OR Brazil OR Bulgaria OR Burkina Faso OR Burundi OR "Cabo Verde" OR Cambodia OR Cameroon OR "Central African Republic" OR Chad OR China OR Colombia OR Comoros OR "Congo" OR "Costa Rica" OR "Côte d'Ivoire" OR Cuba OR Djibouti OR Dominica OR "Dominican Republic" OR Ecuador OR "Egypt" OR "El Salvador" OR "Equatorial Guinea" OR Eritrea OR Eswatini OR Ethiopia OR Fiji OR Gabon OR Gambia OR Georgia) OR ("Developing Countries"[Mesh] OR "low-income countries" OR "middle-income countries" OR LMIC OR resource-limited OR "Africa" OR "South Asia" OR "Latin America" OR "Southeast Asia" OR sub-Saharan Africa OR India OR Turkey OR Brazil OR Philippines OR Pakistan))) OR (("Low-Income Population" OR "Low-Income Populations" OR "Population, Low-Income" OR "Low Income Population" OR "Low Income Populations" OR "Population, Low Income") OR ("Poverty"[Mesh])) AND (((("CT scan" OR "Computed tomography" OR "CAT scan" OR "Spiral CT" OR "Helical CT" OR "Multidetector CT" OR "MDCT" OR "High-resolution CT" OR "HRCT" OR "Tomography, X-ray computed" OR "MRI" OR "Magnetic resonance

imaging" OR "MR imaging" OR "Functional MRI" OR "fMRI" OR "Diffusion-weighted imaging" OR "DWI" OR "Diffusion tensor imaging" OR "DTI" OR "MR spectroscopy" OR "Cardiac MRI" OR "Magnetic resonance angiography" OR "MRA" OR "Magnetic resonance neurography" OR "Nuclear magnetic resonance imaging" OR "Magnetic Resonance Imaging")) OR (("Magnetic Resonance Imaging"[Mesh]) OR ("Spiral Cone-Beam Computed Tomography"[Mesh] OR "Positron Emission Tomography Computed Tomography"[Mesh] OR "Tomography, Spiral Computed"[Mesh] OR "Computed Tomography Angiography"[Mesh]))) AND (((((((((((("Disease Transmission, Infectious"[Mesh]) OR ("Endocarditis"[Mesh] OR "Endocarditis, Bacterial"[Mesh])) OR ("Myocarditis"[Mesh] OR "Chagas Cardiomyopathy"[Mesh])) OR "Pericarditis"[Mesh]) OR "Rheumatic Heart Disease"[Mesh]) OR "Leptospirosis"[Mesh]) OR "Toxoplasmosis"[Mesh]) OR "Filariasis"[Mesh]) OR "Schistosomiasis"[Mesh]) OR "Echinococcosis"[Mesh]) OR "Amebiasis"[Mesh]) OR "Malaria"[Mesh]) OR "Endomyocardial Fibrosis"[Mesh]) OR "Beriberi"[Mesh]) OR ("Sickle Cell Trait"[Mesh] OR "Anemia, Sickle Cell"[Mesh]))) AND (((((((("Cardiomyopathies"[Mesh]) OR "Heart Diseases"[Mesh])) OR "Pulmonary Heart Disease"[Mesh]) OR "Carcinoid Heart Disease"[Mesh]) OR "Heart Disease Risk Factors"[Mesh]) OR "Heart Valve Diseases"[Mesh]) OR (Heart trouble)) OR (Cardiovascular problems)) OR (Heart disorder)))

Stage 3: Study selection

- 8 Include studies that meet the following conditions:
 - 8.1 Study Design: Observational studies (case series, cohort studies, and cross-sectional designs) & RCT's.
 - 8.2 Population: Patients diagnosed with infectious or tropical heart diseases (e.g., myocarditis, infective endocarditis, rheumatic heart disease, tuberculous pericarditis).
 - 8.3 Setting: Studies conducted in low- and middle-income countries (LMICs), as defined by the World Bank classification.
 - 8.4 Imaging Modalities: Use of cardiac MRI, CT, or PET/CT as part of the diagnostic work-up or disease characterization.

- 8.5 Language and Availability: Full-text articles available in English.
- 9 Exclude studies that meet any of the following conditions:
 - 9.1 Conducted exclusively in high-income countries
 - 9.2 Use only echocardiography, ECG, or other non-advanced imaging modalities without CT or MRI.
 - 9.3 Focus on non-infectious, non-cardiac, or non-human conditions.
 - 9.4 Case reports, narrative reviews, systematic reviews, meta-analyses, editorials, commentaries, and conference abstracts.

Stage 4: Data Charting

- 10 Develop the data extraction form by piloting 5 studies and identifying common variables relevant to the use, diagnostic application, and reporting of cardiac MRI and CT in infectious and tropical heart diseases in LMICs
- 11 **Develop Extraction Form with the Following Fields:**
 - 11.1 A. Study Characteristics
 - Authors
 - Year of Publication
 - Country (LMIC)
 - Study Design
 - Sample Size
 - Age and Gender
 - Disease Type
 - Etiology (e.g., bacterial, parasitic, viral)
 - Setting (public/private, tertiary/referral)
 - 11.2 B. Imaging Characteristics
 - Imaging Modality (CT, MRI, PET/CT)
 - Scanner Brand and Strength (e.g., 1.5T, 3T)
 - Contrast Used (Type, Yes/No)

- Group for sequences
- Sequences/Protocols Used
- Diagnostic Approach
- Key Imaging Findings

Stage 5: Collate, Summarize, and Report

- 12 Use tables and figures to summarize frequencies (e.g., disease type, modality).
- 13 Descriptive statistics for sample sizes, modality used, etc.
- 14 The extracted data will undergo narrative synthesis based on the following:
 - 14.1 Geographic and Population Distribution: Country-wise representation of included studies, participant distribution across regions, and gender trends.
 - 14.2 Advanced Imaging Findings in Cardiac Infections: Disease-specific MRI and CT findings.
 - 14.3 Imaging Modalities and Technical Parameters: Use of MRI, CT, and PET/CT; contrast agents reported; ECG-gated CT usage.
 - 14.4 MRI Hardware and Sequences: Scanner types and magnet strength; sequence groups reported (e.g., Cine, LGE, T2W, mapping, edema, fibrosis).
 - 14.5 Findings will be synthesized and presented under these categories, supported by descriptive summaries, tables, and figures that highlight trends, patterns, and gaps identified across the included studies.

Pictorial Essay Integration (in Discussion Section)

- 15 As part of the discussion, a pictorial essay will be incorporated to visually illustrate key imaging findings from selected studies. This section will:
 - 15.1 Present representative cardiac MRI and CT images depicting hallmark features of infectious and tropical heart diseases (e.g., subepicardial LGE in myocarditis, cystic lesions in echinococcosis, calcification in tuberculous pericarditis).



- 15.2 Correlate imaging patterns with disease types, etiology, and diagnostic criteria.

Dissemination

- 16 Submit the final manuscript to a peer-reviewed journal specializing in radiology, cardiovascular imaging, global health, or infectious and tropical diseases.
- 17 Present key results at leading national and international conferences

Timeline:

- 18 Protocol registration and finalization: 2 weeks.
- 19 Literature search and screening: 1 week.
- 20 Full-text review and data extraction: 1 week.
- 21 Analysis and synthesis: 1 week.
- 22 Drafting results and visuals: 1 week.
- 23 Manuscript drafting: 2 weeks.
- 24 Peer review and revision: 2 months.

Protocol references

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