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# MRI safe lower limb traction techniques: A systematic review protocol

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**ADMINISTRATIVE INFORMATION**

**Support -** Nil.

**Review Stage at time of this submission -** Risk of bias assessment.

**Conflicts of interest -** None declared.

**INPLASY registration number:** INPLASY2025100045

**Amendments -** This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 13 October 2025 and was last updated on 13 October 2025.

## INTRODUCTION

**Review question / Objective** What are the different types of MRI safe lower limb traction techniques that have been utilised within the literature for patients undergoing MRIs augmented with lower limb traction?

P: Any patients who have undergone diagnostic MRIs with in situ lower limb traction
I: Any apparatus that applies traction to lower limbs during an MRI Scan
C: This review does not have any comparators
O: Any description (written or visual) of MRI safe lower limb traction methods.

**Rationale** Traction augmented MRIs are valuable tools within musculoskeletal radiology, and have been described literature utilising a wide variety MRI-safe lower limb traction methods. There is currently no systematic review that describes the range of methods currently used.

**Condition being studied** Magnetic resonance imaging of lower limb anatomy assisted with in line traction.

## METHODS

**Search strategy** Ovid database search platform queried with wildcard augmented keywords “MRI”, “magnetic resonance imaging”, “MR”, “Magnetic resonance”, “magnetic resonance arthrog$” “MR arthrog$”, “hip”, “knee”, “ankle”, “femur”, “tibia”, “foot” within the following search algorithm designed to identify relevant papers:

1. (mri or magnetic resonance imaging or MR or magnetic resonance arthrog$ or MR arthrog$).af.
2. exp mri/ or exp magnetic resonance imaging/ or exp MR/ or exp magnetic resonance arthrog$/ or exp MR arthrog$/
3. (hip or knee or ankle or femur or tibia or foot).af.
4. exp hip/ or exp knee/ or exp ankle/ or exp femur/ or exp tibia/ or exp foot/
5. traction.ab.
6. (String 1 or 2) and (String 3 or 4) and String 5

7. remove duplicates from String 6

Abbreviations: .af (all fields search delimiter) .ab (abstract field search delimiter) exp/ (explode functionality) $ (wildcard for any input of any length adjacent to current characters)
Limits: no time/date limits, no language limits.

**Participant or population** Any patients who have undergone diagnostic MRIs with in situ lower limb traction.

**Intervention** Any apparatus that applies traction to lower limbs during an MRI Scan.

**Comparator** This review does not have any comparators.

**Study designs to be included** All studies that provide any description of MRI safe lower limb traction methods will be included regardless of the level of detail.

**Eligibility criteria**
Study characteristics:
- All study types in any setting eligible
- Inclusion criteria: any study where human participants undergo lower limb MRI studies augmented with lower limb traction
- Exclusion criteria: No descriptors (written or visual) of MRI safe lower limb traction methodology
Study report characteristics:
- Any year and any language of publication eligible
- Published reports only.

**Information sources** Embase, Emcare, HMIC, Medline, and Ovid Journals were queried using the Ovid database search platform on 5th May 2025.

**Main outcome(s)** As this is a methodological systematic review focused on describing MRI safe lower limb traction techniques rather than evaluating clinical effectiveness, the primary "outcome" of interest is the description (written or visual) of MRI safe lower limb traction methodology, including:
-Type of traction apparatus (e.g., weights hanging directly, standalone apparatus, pulley systems, frames)
-Use of commercial vs. custom/specially manufactured equipment
-Traction force generation method
-Spatial configuration (fits within scanner vs. extends outside)
-Anatomical location of traction application.

**Additional outcome(s)** Secondary outcomes (descriptive data):
-Study characteristics and settings where traction MRI is utilized
-Patient populations undergoing traction-enhanced MRI
-Reporting quality of traction methodology in the literature
-Authorship/collaborations analysis between studies for trends.

**Data management** OvidSP utilised for database querying, screening result selection, and identification of conflicting Zotero utilised for screened records review, tracking and comparison. Microsoft excel spreadsheet utilised for direct comparison of raw search and screened results as well as identifying inclusion/exclusion conflicts between reviewers.
Two independent reviewers for screening and eligibility of papers in systematic review and data summation.
Excel data file used to keep track of study data and characteristics for each study. Any differences analysed with Microsoft excel comparison function, where differences discussed and resolved either between reviewers or with guarantor to generate master excel data file.

**Quality assessment / Risk of bias analysis** Quality assessment will be with TIDieR for completeness of traction method description.
Risk of bias for individual studies:
Anticipating usage of QUADAS-2 and JBI tools for risk of bias analysis at study level only. Outcomes are not a focus of this paper, only the methodology. Two independent reviewers for risk of bias analysis – any disagreements in rating are discussed, and if needed deciding vote goes to study guarantor. Information from risk of bias analysis will be used in narrative data synthesis

Meta-biases:
Given the methodological nature of this review, traditional publication bias assessment is not applicable as there are no effect estimates to assess for asymmetry. However, analysis of authorship/collaboration between authors amongst studies will be done to yield simple descriptive statistics or diagrams.

**Strategy of data synthesis** Data items collected from studies includes:
Paper authors, language, year, type of study, study focus and key design features, anatomy studied under traction, number of patients, number of joints imaged, whether commercial or specially manufactured device or components are used, whether traction setup fits within scanner, traction force generator, traction apparatus description.

Quantitative synthesis (meta-analysis) will not be appropriate for this methodological review due to clinical and methodological heterogeneity across studies, different anatomical foci within studies (hip, knee, ankle, foot), and primary focus on describing techniques rather than measuring effects.

A structured narrative synthesis will be conducted with the following components:
Descriptive statistics:
-Study counts by publication year, language, and geographical location
-Sample sizes (number of patients and joints imaged)
-Frequency distributions of traction apparatus types
-Categorization of traction styles (direct hanging, standalone, pulley-based, frame-based)
-Authorship and collaboration analysis within all studies
Categorical analysis:
-Anatomical locations (hip, knee, ankle, foot)
-Traction force generation methods
Qualitative synthesis:
-Thematic analysis of traction methodology descriptions
-Visual representation of traction apparatus categories
-Identification of common components and approaches
-Assessment of reporting completeness.

**Subgroup analysis** Subgroup analyses for traction subtypes and anatomical location will be limited to descriptive and simple statistics only without any formal meta-analysis due to the descriptive nature of this review, heterogeneity of study types and varied anatomical foci.

**Sensitivity analysis** N/A - sensitivity analysis is not applicable due to primary focus being description of technique rather than measuring effects.

**Language restriction** No language limits.

**Country(ies) involved** United Kingdom.

**Keywords** MRI traction; MR traction arthrography; MRI safe traction; Hip MRI; joint MRI; knee mri; ankle mri; foot mri; joint distraction.

**Dissemination plans** Peer reviewed publication.

**Contributions of each author**
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