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Diagnosis and treatment strategies of the multiligament injured knee

A SCOPING REVIEW PROTOCOL

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Aims

Multiligament knee injuries (MLKI) are devastating injuries that can result in significant morbidity and time away from sport. There remains considerable variation in strategies employed for investigation, indications for operative intervention, outcome reporting, and rehabilitation following these injuries. At present no study has yet provided a comprehensive overview evaluating the extent, range, and overall summary of the published literature pertaining to MLKI. Our aim is to perform a methodologically rigorous scoping review, mapping the literature evaluating the diagnosis and management of MLKI.

Methods

This scoping review will address three aims: firstly, to map the current extent and nature of evidence for diagnosis and management of MLKI; secondly, to summarize and disseminate existing research findings to practitioners; and thirdly, to highlight gaps in current literature. A three-step search strategy as described by accepted methodology will be employed to identify peer-reviewed literature including reviews, technical notes, opinion pieces, and original research. An initial limited search will be performed to determine suitable search terms, followed by an expanded search of four electronic databases (MEDLINE, EMBASE, Cochrane Database of Systematic Reviews, and Web of Science). Two reviewers will independently screen identified studies for final inclusion.

Dissemination

We will map key concepts and evidence, and disseminate existing research findings to the wider orthopaedic and sports medicine community, through both peer-reviewed and non-peer-reviewed literature, and conference and in-person communications. We will highlight gaps in the current literature and determine future priorities for further research.

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Introduction

Multiligament knee injuries (MLKIs) are defined as a tear of two or more of the major knee ligaments comprising the anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), posteromedial corner (PMC), and posterolateral corner (PLC).[1] Such injuries can have devastating consequences, and there is no comprehensive consensus approach to their investigation and treatment. MLKIs represent a heterogeneous spectrum of pathology and occur less frequently than single ligament injuries, making the design of appropriately powered prospective comparative studies challenging.[2] Despite recent attempts at pooling existing literature to determine optimal approaches for specific aspects of management of MLKIs, there remains considerable variation in strategies employed for investigation, indications for surgical intervention, outcome reporting, and rehabilitation following these injuries.[1,3–7] No

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Table I. Selection criteria for included studies.

Inclusion criteria	Exclusion criteria
Individual case reports, technical notes, opinion pieces, and narrative reviews regarding MLKI	Studies including paediatric patients (aged < 16 years, skeletally immature)
Clinical studies related to MLKI	Studies combining outcomes for both management of single-ligament knee injuries and MLKI
Preclinical studies related to MLKI	Studies not relevant to MLKI
Studies reporting outcomes of management of chronic MLKI	Conference abstracts
	Studies not in the English language
	Studies reporting on patellar tendon rupture, medial patellofemoral ligament rupture in combination with one or more ligaments of the knee joint
	Book chapters

MLKI, multi-ligament knee injuries.

study has yet provided a comprehensive overview evaluating the extent, range, and overall summary of MLKI.

Our aim is therefore to perform a methodologically rigorous scoping review and map the literature evaluating the diagnosis and management of MLKI. The findings of this study would aid shared decision-making about the use of these forms of treatment, while identifying gaps in the literature to establish future research priorities. This study would also identify areas where higher order evidence is limited, where the ascertaining consensus among experts, with extensive experience in the research and management of these injuries would be of value to the wider orthopaedic community.

Methods

The methodological framework for this study is based on that presented by the five-stage scoping review process as proposed by Arksey and O'Malley[8] with adaptations from Levac et al,[9] and the Joanna Briggs Institute.[10] The methodology has been previously employed by recently published orthopaedic scoping reviews.[11,12] This review is designed and will be conducted in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR).[13] For the purposes of this review, the definition of a MLKI is the traumatic disruption of at least 2 of the major ligaments of the knee, comprising the MCL, LCL, PLC, PMC, ACL, or PCL. The following summarizes our approach to each stage.

Stage 1: identify the research question. Considering the populations, concepts, and contexts of interest enabled a broad research question to be formulated: what is currently known about the diagnosis and treatment of multiligament knee injuries in the literature?

Stage 2: identify relevant studies. Table I summarizes the inclusion and exclusion criteria that were developed through researcher discussion and expert consultation.

Search strategy and databases

Step 1: initial limited search. An initial limited search of MEDLINE and EMBASE was conducted. The search terms used were 'multiligament' OR 'multi-ligament' OR 'multi ligament' OR 'multiple ligament' AND 'knee'. Boolean terms 'AND' and 'OR' were used to extract relevant studies. A total of 937 studies resulted from this search. Deduplicating resulted in 589 studies being identified as relevant for initial screening in our limited search. All 589 studies identified were reviewed; 387 studies in total proved relevant, and references from these studies were reviewed for further relevance.

Step 2: identify key words and index terms. The title, abstract, and index terms used to describe included articles will be analyzed to produce a more finely tuned search strategy of key words and index terms, maximizing inclusivity. The final search strategy will amalgamate terms from our initial limited search and keywords identified from relevant articles retrieved through the initial limited search.

The following electronic databases will be searched: MEDLINE (Ovid); EMBASE (Ovid); Cochrane Database of Systematic Reviews; Web of Science; Google Scholar; and the World Health Organization International Clinical Trials Registry Platform.

Step 3: further searching of references and citations. The reference list from eligible studies will be examined to identify any original studies not obtained through the above searches. Citation searching of included studies will also be performed. Authors of all relevant systematic reviews will be contacted for further information.

As scoping reviews are iterative in nature, the search strategy may evolve and search terms may change as reviewers become increasingly familiar with the research and evidence.[8,11] Search strategies will be documented, and the complete final search strategies will be made available from the corresponding author or through supplementary data. Relevant references will be incorporated into a bibliographical manager which will store references, following the deletion of duplicates.

Stage 3: study selection. Relevant titles and abstracts will be evaluated against the eligibility criteria by two reviewers independently (NSM, IRM). The titles and abstracts of eligible studies will be categorized as 'include', 'exclude', or 'uncertain' with disagreement regarding eligibility of

a study resolved by evaluation from a third reviewer thus establishing consensus. If consensus is not reached, the study will proceed to be included. Full texts for all included and 'uncertain' articles will be obtained, and separately evaluated. If subsequently excluded, the reason for exclusion will be documented.

The process of study selection will be reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart.[14]

Stage 4: charting the data. Charting tables similar to that by the Joanna Briggs Institute and previously published orthopaedic scoping reviews will be used to record and assimilate extracted data from the included studies as described below.[10–12] Appropriate data from the eligible studies will be extracted manually using a customized data extraction sheet, in tabular form. The initial limited search strategy will permit development of initial a priori categories, which will be piloted on several studies to ensure that all relevant results are comprehensively extracted. Two reviewers (NSM, IRM) will perform data extraction; any disagreements will be resolved by consensus with review by a third reviewer as required (RFL). If necessary, the categories will be modified, and the extraction sheet revised. The following data will be extracted: first and senior author; journal of publication; year of publication; country of origin of study; study aims; study population and sample size; study design and level of evidence; aspect of MLKI management being studied; setting of study subjects being studied; outcome of intervention and details of these (e.g. How measured); and key findings that relate to scoping review research questions.

Charting results within scoping reviews is typically an iterative process; therefore, the above extraction categories may be adapted depending on the included studies.[11]

Where full-text papers cannot be obtained, efforts to obtain the full-text manuscript via hard or electronic copy will be made. When the paper cannot be found, we will write to the corresponding author to request it. If the full paper still cannot be found, the study will not be included.

Stage 5: collating, summarizing, and reporting the results. The methodology of this scoping review will enable consolidation of the existing knowledge on this subject. The data collected will enable us to map the extent of current evidence available regarding the management of MLKI, provide a concise overview of the breadth and depth of research, summarize existing research findings, identify gaps in the existing literature, and suggest future directions for study.

All relevant results will be reported using the PRISMA-ScR guidelines.[13] In line with the objectives of scoping reviews, a critical assessment of quality and bias of included studies will not be performed as it is beyond the scope of the review.[8,9,11]

Disseminating and communicating results. This scoping review will ultimately inform clinicians, policymakers, and the wider healthcare community on the current landscape, breadth, and depth of evidence regarding the diagnosis and management of MLKI. We will highlight research gaps and thus inform important avenues for future study. The findings of this study would aid shared decision-making regarding suggested reporting methodology for studies assessing aspects of management of MLKI, while identifying future research priorities. This study would also identify challenges within nomenclature and highlight specific aspects of the diagnosis and management of MLKI where higher order evidence is limited, and where ascertaining consensus among experts, with extensive experience in the research and management of these injuries, would be of value to the wider orthopaedic community.

Findings will be summarized in an account for peer-reviewed publication. We will further disseminate the findings of our scoping review using a multiplatform approach. We will present our findings at various conference settings, to orthopaedic surgeons, sports, and rehabilitation organizations, and the general orthopaedic community including allied healthcare professionals. We will also contact relevant experts in the fields of sports orthopaedic surgery, knee surgery, and musculoskeletal medicine to inform our findings and to help communicate key findings to the wider public. Finally, we will harness the use of social media platforms such as Twitter, Facebook, and Instagram to further disseminate our findings nationally and internationally. Scoping review methodology consists of reviewing and synthesizing published data, and thus this aspect of our study is not subject to ethical approval.[9-11]

Conclusion

Scoping reviews are particularly effective for addressing a widely framed research question, in a field where the extent and scope of current evidence is not known. This article presents our protocol for a scoping review, which comprises comprehensive, rigorous, and transparent methodology. This review, which includes peer-reviewed literature, will enable an overview of the wider picture of current research assessing the diagnosis and management of MLKI. This review will also highlight gaps and controversies in the current MLKI literature, and thus provide recommendations for future research and consensus.

Take home message

- There remains considerable variation in strategies employed for the diagnosis and treatment of multiligament knee injuries.
- This protocol describes the methodology for a scoping review that will aim to map key concepts and current evidence regarding the diagnosis and management of multiligament knee injuries, identifying gaps in the current literature and providing suggested directions for future research.

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- Scoping review methodology consists of reviewing and synthesizing published data, and thus this study is not subject to ethical approval.

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