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Postoperative rehabilitation after lower limb amputation due to peripheral arterial disease: Scoping review protocol

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ABSTRACT

Introduction: After lower limb amputation surgery due to peripheral arterial disease, rehabilitation should be initiated early. Rehabilitation reduces complications and mortality, improves functional independence, mobility and prosthesis fitting. Despite the growing number of studies on people who have undergone amputation, no scoping review has yet mapped the evidence on rehabilitation interventions during the acute postoperative hospitalization period.
Objectives: To map which rehabilitation interventions are implemented and evaluated, aimed at people who have undergone lower limb amputation due to peripheral arterial disease, in the postoperative period.
Methodology: The scoping review will follow the Joanna Briggs Institute methodology. Several databases will be searched (MEDLINE (via PubMed), CINAHL (via EBSCO), Cochrane Database of Systematic Reviews, Scopus, PEDro, Web of Science, SciELO, SPORTDiscus with Full Text (via EBSCO), MedicLatina (via EBSCO)), and gray literature sources (Google Scholar, MedNar and RCAAP). Data extraction will use a tool developed based on the research objectives and eligibility criteria. Data synthesis will be presented narratively and in tables.
The review will include studies with adults who underwent lower limb amputation due to peripheral arterial disease. Rehabilitation interventions implemented and evaluated by health professionals to promote functional independence, reduce hospital stay, and prevent complications will be considered. Studies with theoretical proposals, non-applied protocols, or targeting individuals already fitted with prostheses will be excluded.
Conclusion: This review will provide an overview of early postoperative rehabilitation for people with amputation due to peripheral arterial disease, supporting evidence-informed practice and identifying gaps for future research.

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INFORMAÇÃO DO ARTIGO

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RESUMO

Introdução: Após amputação do membro inferior por doença arterial periférica, a reabilitação deve ser iniciada precocemente. A reabilitação reduz as complicações e a mortalidade, melhora a independência funcional, a mobilidade e a adaptação à prótese. Apesar do crescente número de estudos com pessoas submetidas a amputação, ainda nenhuma revisão exploratória mapeou as evidências sobre as intervenções de reabilitação no período de hospitalização pós-operatória aguda.
Objetivos: Mapear quais as intervenções de reabilitação que são implementadas e avaliadas, dirigidas a pessoas submetidas a amputação do membro inferior por doença arterial periférica, no pós-operatório.
Metodologia: A scoping review será conduzida segundo a metodologia do Instituto Joanna Briggs. Serão pesquisadas várias bases de dados (Medline, CINAHL, Cochrane Database of Systematic Reviews, Scopus, PEDro, Web of Science, SciELO, SPORTDiscus, MedicLatina) e fontes de literatura cinzenta (Google Scholar, MedNar e o RCAAP). A extração de dados será realizada com recurso a uma ferramenta desenvolvida com base nos objetivos e critérios de inclusão. A síntese dos dados será apresentada em formato narrativo e em tabelas.
Serão incluídos estudos com adultos submetidos a amputação do membro inferior por doença arterial periférica. Serão consideradas as intervenções de reabilitação implementadas e avaliadas por profissionais de saúde que promovam a independência funcional, reduzam o tempo de internamento e previnam complicações. Serão excluídos estudos com propostas teóricas, protocolos não aplicados ou intervenções dirigidas a indivíduos já protetizados.
Conclusão: Esta scoping permitirá mapear as intervenções de reabilitação no pós-operatório precoce, contribuindo para a prática clínica e para definir futuras linhas de investigação.

Introduction

Peripheral Arterial Obstructive Disease (PAOD) or Peripheral Arterial Disease (PAD) is a common condition, affecting between 10% and 20% of people over 60 years of age, and is one of the main causes of lower limb amputation.[1] This disease leads to reduced blood flow in the lower limbs, potentially resulting in progressive ischemia and serious complications such as gangrene, which is caused by tissue necrosis resulting from inadequate blood supply.[2] Bypass surgery is an option to restore arterial circulation, but in cases of advanced ischemia, amputation may be unavoidable.[3,4] Lower limb amputation has a profound impact on individuals' quality of life, affecting mobility, independence and mental health, as well as causing a significant impact on family support.[5,6] PAD, often associated with risk factors such as diabetes mellitus, hypertension and smoking, accounts for approximately 54% of lower limb amputations. The increasing prevalence of diabetes and the aging population further contribute to the rising incidence of these procedures.[4] People with PAD often have multiple comorbidities, such as kidney disease, COPD, and heart disease, which makes rehabilitation even more challenging.[7,8]

Major amputations have a high mortality rate, with life expectancy reduced by over 70% for these individuals.[9] In the United States of America, more than 80% of lower limb amputees have associated arterial disease and are generally older and frail.[10] Five-year mortality after amputation can range from 53% to 100%, being slightly higher in above-knee amputations.[11] Lack of continuity of care after hospital discharge is another factor that increases the risk of complications. Improving the transition between hospital care and community or rehabilitation services is therefore essential to mitigate these risks.[12] Among the most frequent postoperative complications after amputation surgery, the following can be mentioned: phantom pain, phantom sensation, dehiscence, infection, edema, joint stiffness, neuroma and hemorrhage.[13]

In this context, early rehabilitation emerges as a critical factor, being associated with reduced mortality, lower risk of reamputation and greater functional independence, in addition to enabling discharge home.[14] Early rehabilitation also contributes to accelerated gait and reduced hospital stay.[10] However, implementation of this approach faces challenges due to the short period available before surgery, the advanced age of individuals, and multiple comorbidities.[15] Pain, postoperative psychological distress, and poor adherence to early mobilization are additional barriers that need to be overcome to ensure effective recovery.[16–18]

People with multiple amputations face even greater challenges in their rehabilitation process, which must be adjusted to the reality of each individual and rely on family support.[19] Depression, with a prevalence of 60,6% among amputees, is an aggravating factor, being frequently associated with alcoholism, claudication, diabetes and chronic pain, which further reduces the functional capacity of these individuals.[20] Hospital rehabilitation has shown good results in the functional recovery of subjects without prostheses, which is essential to improving the functionality and quality of life of these individuals . The involvement of caregivers in the postoperative rehabilitation process is equally essential, as they play a fundamental role in home care and need to be adequately trained to support the person's recovery.[21] Comorbidities associated with PAD, such as diabetes, hypertension, renal failure and cognitive alterations, can impair postoperative recovery, but hospital rehabilitation, even without the use of prostheses, has shown positive results in improving functionality and reducing mortality.[22] The implementation of early rehabilitation protocols, together with a well-structured discharge plan, can significantly improve the recovery and quality of life of individuals undergoing amputation, promoting the reduction of mortality and the prevention of long-term complications.

Although the study conducted by the previous authors was a pilot randomized controlled trial involving individuals (after amputation due to arterial disease or trauma) who underwent postoperative rehabilitation applied not only in a hospital context (but also at home), the results allowed us to conclude that the implementation of a rehabilitation program resulted in improved functional mobility.[23]

When it comes to chronic diseases (like PAD), these have an impact on morbidity and mortality. Nursing interventions were mapped through a scoping review and the authors found that they had an impact on reducing hospital readmissions, emergency room visits, mortality, costs and improving quality of life.[24]

A preliminary search was carried out in the MEDLINE databases (via PubMed), Cochrane Database of Systematic Reviews, PROSPERO and Open Science Framework (OSF), to identify systematic reviews or scoping reviews already published or in development on the topic. In this research, a recently published scoping review was identified that aimed to map the available evidence on early postoperative rehabilitation programs for individuals with reported vascular-related amputations.[25] This study identified significant gaps in literature, particularly the paucity of research on early mobilization after amputation and the predominance of observational studies, with no randomized controlled trials or systematic reviews providing robust evidence. Although this review provides an initial overview of the topic, it has important limitations. First, the authors restricted their search to a specific set of databases, which may have limited the scope of the results. Furthermore, the search was conducted exclusively in English and did not transparently detail the search strategy used, making it impossible to validate the exhaustiveness of the articles included. Another relevant aspect is that the existing review focuses mainly on early postoperative rehabilitation in the context of the use of temporary prostheses, such as Immediate Postoperative Prosthesis (IPOP) and pneumatic devices for early mobilization. Although this approach is valuable, it may not reflect the reality of all clinical scenarios, including those in which the use of temporary prostheses is not common practice in the immediate postoperative phase. Thus, the present study proposes a broader approach, analyzing early mobilization regardless of the use of a prosthesis, in addition to exploring other aspects of post-amputation rehabilitation, such as strategies for preventing complications, functional results and patients' quality of life.

Furthermore, this study aims to expand the search to additional databases, include literature published in all languages - ensuring a more inclusive and comprehensive perspective - and provide a rigorously detailed search strategy to ensure greater transparency and reproducibility. Thus, this study seeks to address previously identified limitations and contribute to a more comprehensive and representative perspective on early rehabilitation after amputation.

The objective of this scoping review is to map the rehabilitation interventions implemented and evaluated, aimed at people who underwent lower limb amputation due to peripheral arterial disease, in the postoperative period.

Methodology

The proposed scoping review will be conducted in accordande with JBI methodology for Scoping Reviews[26] and in line with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for Scoping Reviews (PRISMAScR) extension.[27] The review has been registered in OSF (DOI 10.17605/OSF.IO/PW5C4).

Review question

The main question is: What rehabilitation interventions have been implemented and evaluated, aimed at people who have undergone lower limb amputation due to peripheral arterial disease, in the postoperative period?

In addition to the main research question, this scoping review aims to explore the following secondary aspects: What are the characteristics of the identified rehabilitation interventions (e.g. frequency, duration, intensity, periodicity, continuity after hospitalization)? Which health professionals are responsible for implementing these interventions? What types of amputation are addressed within the scope of these interventions? What are the reported outcomes of these interventions concerning functional independence (e.g. hospital length of stay, ability to

walk, level of independence, occurrence of complications, prosthetic fitting)?

Inclusion criteria

Participants

This scoping review will consider studies that include individuals over the age of 18 years who underwent lower limb amputation for peripheral arterial disease, regardless of the level of amputation. Therefore, this review will consider all foot amputations, infracondylar (or transtibial), supracondylar (or transfemoral) and lower limb disarticulation surgeries, regardless of the surgical technique performed.

Studies that study people with unspecified vascular pathology, peripheral vascular disease or vascular arterial disease will be considered.

Concept

This scoping review will consider studies that include implemented and evaluated rehabilitation interventions aimed at people who have undergone lower limb amputation due to peripheral arterial disease. Interventions described in isolation or integrated into structured rehabilitation programs will be considered, provided that they have been effectively applied in clinical practice and their impact has been evaluated.

Rehabilitation interventions will be included regardless of who implements them (nurses, rehabilitation nurses, physiotherapists, physiatrists, among other health professionals).

These interventions should aim to accelerate the functional independence of the person undergoing amputation, reduce the length of hospital stay, promote early resumption of walking, promote return home and enable the person to fit a prosthesis in the future successfully.10

Studies that present only theoretical proposals, non-applied protocols or interventions aimed exclusively at people who already have prostheses will be excluded. Studies that only present protocols created but not implemented in clinical practice will be excluded.

Context

This scoping review will consider studies conducted in different surgical contexts (vascular surgery, general surgery, among others) where lower limb amputations are performed due to peripheral arterial disease and where people remain for a few days until they are discharged home or transferred to other institutions. Contexts in which people are integrated into rehabilitation programs will also be considered, as long as these have been implemented in the acute postoperative period,[28] corresponding to the initial phase of the rehabilitation process, still without prosthetics.

Interventions aimed exclusively at the preoperative period, late postoperative period, pre-prosthetic or post-prosthetic phase will also be excluded, since the focus of this review is on interventions aimed at effectively starting the rehabilitation process, during hospitalization or in the clinical context immediately following surgery.

Types of Sources

This scoping review will consider both experimental and quasi-experimental study designs, including randomized controlled trials, non-randomized controlled trials, before and after studies and interrupted time-series studies. In addition, analytical observational studies, including prospective and retrospective cohort studies, case-control studies and analytical cross-sectional studies will be considered for inclusion. This review will also consider descriptive observational study designs, including case series, individual case reports and descriptive cross-sectional studies for inclusion.[29]

Qualitative studies will also be considered that focus on qualitative data, including, but not limited to, designs such as phenomenology, grounded theory, ethnography, qualitative description, action research and feminist research.

In addition, systematic reviews that meet the inclusion criteria will also be considered.

Search strategy

The search strategy will aim to locate published and unpublished studies. A three-step research strategy will be utilized in this scoping review. First, an initial limited search of MEDLINE (PubMed) and CINAHL (via EBSCO) was undertaken to identify articles on the topic. Text words contained in the titles and abstracts of these articles, along with the index terms used to describe them, were used to develop a full search strategy. This strategy will then be adapted and applied to all other selected databases and information sources.[29] Table 1 presents the complete MEDLINE search strategy and the complete CINHAL search strategy carried out on 09/04/2025. Additionally, the reference lists of all included sources of evidence will be screened for further relevant studies. The analysis of non-randomized prospective studies of vascular patients undergoing amputation demonstrated the importance of implementing a rehabilitation program, which, although extensive in terms of application time, begins in the acute postoperative period.[10]

The scoping review conducted by Wong[25] on this topic, in addition to time limitations, language limitations and limited database research, focuses mainly on people already fitted with prostheses in the acute postoperative period, an aspect that is not common in all countries, such as Portugal, with this scoping aiming to focus on rehabilitation in people without prostheses.

The search strategy will not be limited by language or publication date to ensure a comprehensive approach and capture all available evidence on implemented and evaluated rehabilitation interventions.

In this scoping review, the following information sources and databases will be searched: Medline (via PubMed), CINAHL (via EBSCO), Cochrane Database of Systematic Reviews, Scopus, PEDro, Web of Science, SciELO. SPORTDiscus with full text (via EBSCO), MedicLatina (via EBSCO). Sources of unpublished studies and grey literature will also be searched: Google Scholar, MedNar and RCAAP.

Table 1. MEDLINE and CINAHL search strategy.

MEDLINE search strategy (via PubMed)
Results: 252 Search strategy (09-04-2025)
(((((limb loss[Title/Abstract]) OR (amput*[Title/Abstract])) OR (amputation, surgical[Title/Abstract])) AND ((((((((((((vascular disease[Title/Abstract]) OR (dysvascular[Title/Abstract])) OR (DAP[Title/Abstract])) OR (DAOP[Title/Abstract])) OR (peripheral arterial disease[Title/Abstract])) OR (peripheral artery disease[Title/Abstract])) OR (peripheral vascular disease[Title/Abstract])) OR (critical limb ischemia[Title/Abstract])) OR (ischemic amputation[Title/Abstract])) OR (vascular disease[MeSH Terms])) OR (arterial oclusive diseases[MeSH Terms])) OR (peripheral arterial disease[MeSH Terms]))) AND ((((((((((rehabilitation[Title/Abstract]) OR (physiotherapy[Title/Abstract])) OR (exercise therapy[Title/Abstract])) OR (early mobilization[Title/Abstract])) OR (physical therapy[Title/Abstract])) OR (rehabilitation nursing[Title/Abstract])) OR (hospitals, rehabilitation[Title/Abstract])) OR (early ambulation[Title/Abstract])) OR (health education[Title/Abstract]))) AND ((((((((((((inpatient[Title/Abstract]) OR (postoperative[Title/Abstract])) OR (post-operative[Title/Abstract])) OR (postsurgery[Title/Abstract])) OR (post-surgery[Title/Abstract])) OR (acute care[Title/Abstract])) OR (hospital stay[Title/Abstract])) OR (post-amputation care[Title/Abstract])) OR (surgical recovery[Title/Abstract])) OR (postoperative period[Title/Abstract])) OR (postoperative care[Title/Abstract])) OR (inpatients[Title/Abstract]))
CINAHL search strategy (via EBSCO)
Results: 90 Search strategy (09-04-2025)
("Limb loss" OR Amput*) AND ("Vascular disease" OR Dysvascular OR DAP OR DAOP OR "Peripheral arterial disease" OR "Peripheral artery disease" OR "Peripheral vascular disease" OR "Critical limb ischemia" OR "Ischemic amputation") AND (Rehabilitation OR Physiotherapy OR "Exercise therapy" OR "Early Mobilization" OR "Physical Therapy") AND (Inpatient OR Postoperative OR "Post-operative" OR Postsurgery OR "Post- surgery" OR "Acute care" OR "Hospital stay" OR "Post-amputation care" OR "Surgical recovery")

Study/Source of evidence selection

Following the search, all identified citations will be collated and uploaded into Mendlley® V1. 19.8 (Mendeley Ltd., Elsevier, Netherlands) and duplicates will be removed. The items will then be imported into Rayyan QCRI (Qatar Computing Research Institute, Doha, Qatar). Following a pilot test, titles and abstracts will then be screened by two or more independent reviewers for assessment against the inclusion criteria for the review. Potentially relevant sources will be retrieved in full and their citation details imported into the JBI System for the Unified Management, Assessment and Review of Information (JBI SUMARI) (JBI, Adelaide, Australia).[30] The development of software to support multiple systematic review types: the Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (JBI SUMARI).[29]

The full text of selected citations will be assessed in detail against the inclusion criteria by two or more independent reviewers. Reasons for the exclusion of sources of evidence at full text that do not meet the inclusion criteria will be recorded and reported in the scoping review. Any disagreements that arise between the reviewers at each stage of the selection process will be resolved through discussion, or with an additional reviewer/s. The results of the search and the study inclusion process will be reported in full in the final scoping review and presented in a PRISMA flow diagram.[29]

Data extraction

Data will be extracted from papers included in the scoping review by two or more independent reviewers using a data extraction tool developed by the reviewers. The data extracted will include specific details about the participants (people undergoing lower limb amputation due to peripheral arterial occlusive disease), concept (rehabilitation interventions targeting individuals before prosthesis fitting), context (acute post-operative), study methods and key findings relevant to the review questions.[29]

A draft extraction form is provided (*Table 2*). The draft data extraction tool will be modified and revised as necessary during the process of extracting data from each included evidence source. Modifications will be detailed in the scoping review. Any disagreements that arise between the reviewers will be resolved through discussion or with an additional reviewer. If appropriate, authors of papers will be contacted to request missing or additional data, where required.

Table 2. Data extraction tool.

Characteristics of the evidence source

Author(s)	
Year of Publication	
Country	
Objectives	
Population and sample size	

Results extracted from the evidence source

Isolated Intervention or Program	
Implementation time frame	
Frequency of implementation	
Strategy for continuing rehabilitation after hospitalization	
Healthcare professionals	
Context of implementation	
Evaluated Parameters	
Considered types of amputations	
Postoperative complications	
Cause of amputation	
Outcomes	

Data analysis and presentation

The data collected will be used to address the research objectives and questions, so they will be presented diagrammatically or in tabular form. A narrative summary will accompany the tabulated and/or graphical results and describe how the results relate to the review purpose and questions.[26]

Conclusion

This scoping review aims to map and synthesize the evidence on implemented and evaluated rehabilitation interventions in the postoperative period for individuals undergoing lower limb amputation due to peripheral arterial disease. It is expected that the findings will contribute to a deeper understanding of current practices, identify gaps in the available evidence, and highlight the strategies that best support early functional recovery and preparation for prosthetic fitting. The outcomes of this review may inform future research, clinical practice and decision-making in the design of rehabilitation programs, ultimately improving patient care trajectories and outcomes.

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Conflicts of Interest

No conflicts of interest were declared by the authors.

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