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Research

Physical function assessment scales used in the rehabilitation of lower extremity lymphedema: A scoping review

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ABSTRACT

Background: The identification of a standard measure of physical function of patients with lower extremity lymphedema seems to be missing.

Objective: This study aimed to identify the physical function assessment scales used in the rehabilitation of patients with lower extremity lymphedema.

Methods: A scoping review was conducted by searching four electronic databases and performing a manual search. Prior to the scoping review, search terms and synonyms related to lymphedema and physical function assessment scales were identified, and a search strategy was developed.

Results: A total of 176 results were retrieved, and six articles were analyzed after screening. The most commonly reported assessment scale was the Timed up and Go test.

Conclusions: Current assessment scales of physical function in lower extremity lymphedema are dominated by the Timed up and Go test. However, the subject remains controversial due to the small number of studies related to evaluation measures.

KEY WORDS : lower extremity lymphedema, physical function, assessment scales, scoping review

Introduction

Lower extremity lymphedema is a common disease including primary (no specific causative agent) or secondary (after cancer treatments, trauma, or filarial infection) types. It is a chronic localized form of tissue swelling resulting from the excessive retention of lymphatic fluid in the interstitial compartment caused by impaired lymphatic drainage[1]; however, its pathophysiology remains largely unknown. Although lymphedema is not considered life-threatening, a previous report has highlighted its detrimental consequences on patients, including distress, pain, functional impairment, and infections, with a relevant decrease in

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quality of life (QOL)[2]. In order to solve these problems, determining suitable treatment and management are critical.

Management of lower extremity lymphedema is conducted using Complex Decongestive Therapy (CDT), followed by skin care, lymph drainage, compression, and exercises. A previous systematic review suggested that CDT is effective at reducing the volume of the affected limb in lower extremity lymphedema[3]. Furthermore, several investigators have reported an increased QOL after CDT in patients with both primary and secondary lower extremity lymphedema[4-6].

However, little attention has been given to the changes in the physical function of patients with lower extremity lymphedema throughout their rehabilitation. In general, patients with lower extremity lymphedema fear falling, slow walking speed, and low physical activity and functionality. According to most international lymphedema guideline, it is recommended that lymphedema therapists perform a physical examination on these patients[7], but the identification of a gold standard measure of the physical function of patients with lower extremity lymphedema to bridge this gap seems to be missing. Therefore, it cannot be discussed whether lymphedema treatment effectively improves physical function. Furthermore, it is unclear what studies have been conducted at this time from the physical function point of view. Physical function assessment scales must therefore be determined to establish evidence of successful lymphedema rehabilitation.

In this scoping review, we aimed to identify the physical function assessment scales used in published research articles related to the rehabilitation of patients with lower extremity lymphedema. Furthermore, a scoping review was utilized to systematically gather existing knowledge and thoroughly investigate unresolved areas requiring further research in an exploratory manner. Identifying the assessment scales can be used to determine how to measure changes in physical function in lymphedema treatment and can also be used to determine true treatment efficacy.

Materials and methods

1. Study design

We conducted a scoping review following the five-stage framework initially presented by Arksey and O'Malley[8] and further developed by Levac[9]. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping review (PRISMA-ScR) guidelines were also followed[10,11].

2. Framework stage 1: identifying the research question

We defined the research question in this study as follows: "which physical function assessment scales are used during the rehabilitation of patients with lower extremity lymphedema?".

3. Framework stage 2: identifying relevant studies

The article search was conducted on November 1, 2023. All articles were written in English and published by the search date. Four electronic databases (PubMed, Cochrane Library, PEDro, and OT Seeker) were searched. In the database search, the key concepts were divided into five items, namely, pathological condition, treatment, site, physical function, and outcome measurement. In the pathological condition and treatment sections, one term was used ("lymphedema" and "rehabilitation", respectively). In the site section, two terms were used ("lower extremity" and "lower limb"), while in the physical function section, three terms were used ("physical", "function*", and "performance"). Finally, in the outcome measure section, five terms were used ("outcome", "parameter", "measurement", "task", and "assessment"). The Boolean operators "OR" and "AND" were used to link the search terms from each concept. A list of key concepts and search terms is presented in **Table 1**. In addition, to the database search, we obtained references through a manual search.

The following criteria were used for inclusion in the study: (1) inclusion of physical function assessment scales; (2) use of noninvasive and commonly used assessments in rehabilitation practice; (3) original articles with a study design demonstrating a level of evidence higher than that typically found in observational studies; and (4) the author or evaluators were not limited to rehabilitation-related professions.

The exclusion criteria were as follows: (1) use of

Table 1 List of the key concepts and search terms

Key concepts	No.	Search terms
Pathological condition	# 1	lymphedema
Treatment	# 2	rehabilitation
Site	# 3	"lower extremity"
	# 4	"lower limb"
	# 5	(#3 OR #4)
Physical function	# 6	physical
	# 7	function*
	# 8	performance
	# 9	(#6 OR #7 OR #8)
Outcome measurement	#10	outcome
	#11	parameter
	#12	measurement
	#13	task
	#14	assessment
	#15	(#10 OR #11 OR #12 OR #13 OR #14)
Search formula	#16	#1 AND #2 AND #5 AND #9 AND #15

subjective measurements alone, such as the Visual Analogue Scale and Numerical Rating Scale; (2) exclusive measurement of the circumference or volume of the affected extremity for physical function assessment; (3) intervention or treatment utilizing invasive approaches; (4) certain study designs, including case reports, review articles, systematic reviews, and meta-analyses; and (5) conference abstracts.

4. Framework stage 3: study selection

Two independent reviewers examined the inclusion and exclusion criteria for all relevant articles. In cases of disagreement between the two raters, a third reviewer was consulted to reach a consensus on article inclusion. During the first screening, titles and abstracts of the retrieved articles were reviewed. Furthermore, in the second screening, the full texts of the articles selected during the first screening were checked to make a final decision regarding eligibility.

5. Framework stage 4: charting the data

The reviewers collaboratively developed a data extraction method. Based on the research question and review purpose, the extraction categories were as follows: first author, year of publication, article title, study location, study design, number of participants, intervention, lymphedema measurement (circumference and/or volume), physical function assessment scales, and other measurement tools.

6. Framework stage 5: collating, summarizing, and reporting the results

Data were extracted from all eligible articles, and numerical and thematic analyses were performed. For the thematic analysis, we identified how the articles were related to the research question and created codes (labels) that best reflected the assessment of physical function assessment scales. After repeating the code creation process and successfully identifying patterns among the codes, categories were created. The results of the numerical and thematic analyses are presented in **Table 2**.

7. Ethical statement

The authors' institutions confirmed that no ethics committee approval was required for this study.

Results

A total of 176 results were obtained from all sources. Duplicate articles were excluded (n=38), yielding 138

Table 2 Synthesis of eligibility article characteristics

No.	First Author, Year of publication	Study location	Title	Study design	Number of subjects	Intervention (lymphedema treatment)	Lymphedema measurement		Outcome measure of physical function				Other measurement tools
							Circumference	Volume	Muscle Strength	Balance	Exercise tolerance	PROMs	
1	Koehler L, 2023 [12]	United States	Functional and psychosocial quality of life in gynecologic Cancer survivors with and without lymphedema symptoms	Cross-sectional study	185 patients (symptomatic: asymptomatic= 105: 80)	No intervention (cross-sectional study)	None					●	・Fact-G score ・Distress thermometer
2	Sahinoglu E, 2022 [13]	Turkey	The efficacy of change in limb volume on functional mobility, health-related quality of life, social appearance anxiety, and depression in patients with lower extremity lymphedema	Before-and-after study	27 patients with unilateral lower extremity lymphedema	Complex decongestive physiotherapy (20 sessions)		○		●			・Short Form-36 ・Social Appearance Anxiety Scale ・Beck Depression Inventory
3	Angst F, 2020 [14]	Switzerland	Cross-sectional validity and specificity of comprehensive measurement in lymphedema and lipedema of the lower extremity: a comparison of five outcome instruments	Cross-sectional study	107 patients with lymphedema	Treatment consisted in intensive complex decongestive lymphatic therapy and comprehensive rehabilitation	None				●		・Short Form-36 ・FLQA-lk ・KOS-ADL ・SCL-90R
4	Cau N, 2019 [15]	Italy	Preliminary evidence of effectiveness of TECAR in lymphedema	Randomized controlled trial	48 patients with bilateral lymphedema	All 48 patients were divided into three groups undergoing either manual lymphatic drainage, pressure therapy, or TECAR, in addition to a 4-week multidisciplinary rehabilitation program	○			●			・Visual Analog Scale (pain/heaviness)
5	Pedrosa BCS, 2019 [16]	Brazil	Functionality and quality of life of patients with unilateral lymphedema of a lower limb: a cross-sectional study	Cross-sectional study	25 patients with unilateral lymphedema	No intervention (cross-sectional study)	○	○		●			・Short Form-36 ・Lymph-ICF-LL
6	Do JH, 2017 [17]	South Korea	Effects of a complex rehabilitation program on edema status, physical function, and quality of life in lower-limb lymphedema after gynecological cancer surgery	Randomized controlled trial	40 patients with secondary unilateral lymphedema	Two groups: CDT: complex decongestive therapy CRCDT: complex rehabilitation (stretching, strengthening, and aerobic exercises) + CDT		○	●				・EORTC QLQ-C30 ・GCLQ-K

EORTC QLQ-C30: European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire Core 30; FLQA-lk: Freiburg Quality of Life Assessment for lymphatic disorders Short Version; GCLQ-K: Gynecologic Cancer Lymphedema Questionnaire-Korean; KOS-ADL: Knee Outcome Survey Activities of Daily Living; Lymph-ICF-LL: Lymphoedema Functioning, Disability and Health Questionnaire for Lower Limb Lymphoedema; PROMs: Patient-reported outcome measures; SCL-90R: Symptom Checklist-90-revised

○ and ●: Measurements used in the articles

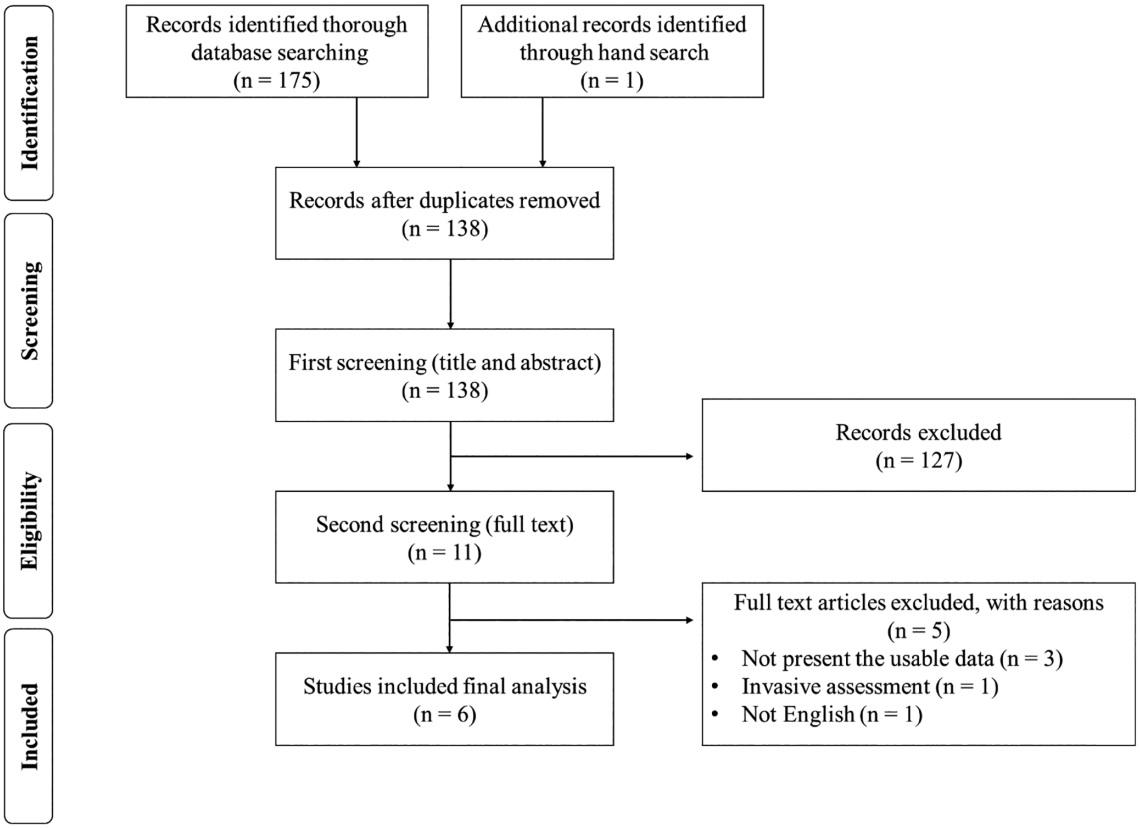

Figure 1 PRISMA flow diagram

articles for eligibility screening. The titles and abstracts were screened, and 127 articles were excluded. The full text of 11 articles was examined and assessed for eligibility, and an additional five articles were excluded. Finally, six eligible articles 12–17 were analyzed in the present study. The number of articles reviewed, selected, and checked at each stage are shown in the PRISMA flow diagram[10) 11)] (**Figure. 1**).

1. Synthesis of eligible article characteristics

Table 2 summarizes the characteristics of the eligible articles. Six articles published between 2017 and 2023 were included in this review. These studies were conducted in the United States, Turkey, Switzerland, Italy, Brazil, and South Korea. Regarding their design, the included articles were cross-sectional studies (n=3), randomized controlled trials (n=2), and before-and-after study (n=1). A total of 352 patients with lower extremity lymphedema were included in this review. The pathogenic factor of the lower extremity lymphedema differed in all studies. The interventions in the articles were CDT-related (n=4), and none for observational studies (n=2). The morphometric measurements of lymphedema included circumference (n=1), volume (n=2), circumference and volume (n=1), and none (n=2).

2. Reported physical function assessment scales

The reported physical function assessment scales are presented in **Table 3**. We identified five types of physical function assessment scales and four categories (muscle strength, balance, exercise tolerance, and patient-reported outcome measures [PROMs]). The most reported assessment scale was the Timed up and Go test (n=3).

Discussion

We conducted a scoping review to identify the physical function assessment scales of lower extremity lymphedema. As a result, six articles met the inclusion criteria. This article provides an overview developed from the current perspectives and views on these results.

This review revealed that the measures of lower extremity physical function include muscle strength, balance, exercise tolerance, and PROMs. Among them, the most used assessment scales measure was the

Table 3 Reported physical function assessment scales

Category	Outcome measure	Authors (Year of publication)
Muscle strength	Knee extensor (handheld dynamometer)	Do JH (2017)[17]
	30-s chair stand test	Do JH (2017)[17]
Balance	Timed Up & Go test	Sahinoglu E (2022)[13]
		Cau N (2019)[15]
		Pedrosa BCS (2019)[16]
Exercise tolerance	6-min walking test	Angst F (2020)[14]
PROMs	Lower Extremity Function Scale	Koehler L (2023)[12]

PROMs: Patient-reported outcome measures

Timed up and Go test in the balance category. The Timed up and Go test is the time (in seconds) a person takes to stand up from a standard armchair, walk three meters (i.e., 10 feet), turn around, walk back to the chair, and then sit down again. This scale is considered a comprehensive measure of mobility because it assesses the dynamic balance capacity during standing and walking[18]. Although the original Timed up and Go test was designed for older adults, it is now used in patients with many diseases that impair balance such as stroke[19], Parkinson's disease[20], cancer[21], and frailty[22,23]. The eligible three Timed up and Go test articles[13,15,16] included in this review showed impaired balance in patients with lower extremity lymphedema, both before rehabilitation and in cross-sectional studies. The Timed up and Go test is a simple and widely used measure that may be suitable as a simple physical function assessment tool in patients with lower extremity lymphedema. However, the gold standard of physical function assessment scales in lower extremity lymphedema remains controversial since articles related to other categories of physical function have shown distinct functional characteristics[12-17].

Additionally, the review results showed that this subject has not been adequately addressed in rehabilitation-related articles over the years. Until recently, only a few clinical trials had assessed the benefits of treatment on the physical function of patients with lower extremity lymphedema. On the other hand, the articles eligible for this study confirmed that lower extremity lymphedema could markedly undermine physical functioning[12-17] and suggest a recent trend toward developing initiatives to objectively assess patients with lower extremity lymphedema for a variety of physical dysfunctions. However, the number of articles addressing any evaluation measures was small, and further accumulation of knowledge is necessary to standardize the measures used. In addition, previous exploratory studies have used existing assessment measures to evaluate these patients' function. In the future, it is expected that further studies will be conducted to develop a more specific evaluation measure for assessing physical function in this patient population.

This study had some limitations. First, we searched the electronic databases from their inception until November 1, 2023. Documents published after this date were excluded from the analysis. Second, this scoping review excluded non-English articles, grey literature, and previous review articles. Finally, we did not assess the effectiveness of lymphedema therapy in patients with lower extremity lymphedema using each physical function assessment scale as it is optional in the PRISMA-ScR guidelines[10,11]. As scoping studies do not aim to assess the quality of evidence, they cannot determine whether particular studies provide robust or generalizable findings.

Conclusion

We demonstrated the physical function assessment scales currently used in the evaluation of lower extremity lymphedema. This study classified the physical function assessment scales into four categories and five types. Current assessment scales of lower

extremity lymphedema were dominated by the Timed up and Go test. However, no consensus has been reached as to the best method of assessing physical function assessment scales in patients with lower extremity lymphedema.

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Disclosure statement

The authors report no conflicts of interest.

Data availability statement

Data are available upon reasonable request from the corresponding author.

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