ORIGINAL ARTICLE

GRIP STRENGTH IN GERIATRIC PATIENTS WITH LYMPHEDEMA FOLLOWING BREAST CANCER TREATMENT

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Abstract

Introduction: Grip strength represents a critical, objective indicator of functional capacity in daily activities. This study sought to elucidate the impact of breast cancer-related lymphedema on grip strength and to explore the underlying factors contributing to its decline.

Materials and method: This is a retrospective study including patients over the age of 65 who presented to our outpatient clinic after developing lymphedema following breast cancer treatment. Hand grip strength was measured using a hand dynamometer in patients with lymphedema, and data on lymphedema stage and clinical parameters were collected.

Results: In older adults with lymphedema, grip strength was significantly reduced on the affected side (median: 8.0 kg [3–21]) compared to the non-affected side (median: 16.5 kg [10–29]; $p < 0.001$). Patients with more advanced stages of lymphedema were found to have lower grip strength on the affected side compared to those with earlier stages. In older adults with lymphedema, grip strength was also correlated with the subscales of quality of life and with fatigue, both considered important clinical outcomes.

Conclusion: Our findings highlight that lymphedema in older adults is associated with clear functional impairment, as evidenced by reduced grip strength on the affected side and a progressive decline across disease stages, underscoring the importance of early intervention to preserve hand function.

Keywords: Lymphedema; Breast Neoplasms; Aged; Hand Strength.

INTRODUCTION

Breast cancer is the second leading cause of death among women worldwide, and its incidence continues to rise globally (1, 2). Breast cancer management involves a range of therapeutic strategies, with surgical intervention remaining a cornerstone for both diagnostic clarification and treatment in the majority of cases. However, these interventions may disrupt axillary lymphatic flow, often leading to lymphedema as a common complication (3). Lymphedema is a swelling-related condition that usually affects individuals after mastectomy for breast cancer, leading to a reduced quality of life and creating a significant financial burden (4). In lymphedema, protein-rich fluid accumulates in the tissues, leading to persistent swelling and gradual structural changes (3).

Upper limb lymphedema following surgery can markedly reduce the mobility and functional capacity of the affected arm. As a result of lymphedema, patients may develop swelling, pain, and fibrosis, accompanied by restrictions in self-care, and in severe cases, long-term loss of upper limb function (5). Hand grip strength is a simple and cost-effective tool for evaluating muscular strength and has been shown to correlate with various measures of upper limb function (6). Among patients aged 40–60 with lymphedema, the difference in grip strength between their extremities was found to be greater compared to those without lymphedema (7). Considering the importance of grip strength measurements in a holistic assessment of geriatric patients, evaluating handgrip becomes particularly crucial when lymphedema—an upper extremity condition that can impair grip—is present. Grip strength is not only an indicator of upper limb function in older adults, but is also widely recognized as a reflection of overall physical strength. Furthermore, it provides valuable insights into how functional capacity may change over time (8).

Lymphedema related to breast cancer treatment may emerge shortly after surgery or even many years later, with reported cases occurring up to 11 years postoperatively (9). It remains unclear which factors contribute to the development of lymphedema in breast cancer patients following mastectomy. The primary aim of this study was to evaluate hand grip strength between the affected and non-affected upper extremities in older adults with breast cancer–related lymphedema, with consideration of the potential impact of clinical parameters such as diagnosis time, lymphedema stage, functional mobility, performance, quality of life, comorbidities, cancer stage, pain, and fatigue levels on grip strength in the affected side.

MATERIALS AND METHOD

This retrospective study included 50 patients aged 65 years and older who visited the physical medicine and rehabilitation outpatient clinic between April 1, 2023, and April 30, 2025, and developed lymphedema during their breast cancer treatment. Demographic and clinical data, including age, disease stage, lymphedema stage, year of diagnosis, chemotherapy, radiotherapy, and hormone therapy treatments were recorded for all participants. Patients undergoing active chemotherapy or radiotherapy were not included in the study.

Hand grip strength was evaluated in kilograms using a Jamar dynamometer, with participants seated and elbows flexed at 90 degrees during the assessment. In this study, differences in hand grip strength between the affected and non-affected sides were examined, with further analysis addressing the potential impact of clinical parameters on grip strength in the affected side.

Lymphedema staging was determined according to standard clinical criteria: Stage 0 indicates normal limb appearance with impaired lymphatic transport (e.g., demonstrated by lymphoscintigraphy); Stage 1 represents early edema that subsides with limb elevation; Stage 2 is characterized by pitting edema

that does not resolve with elevation; and Stage 3 is marked by fibroadipose tissue accumulation and skin changes.

The assessment of quality of life was conducted using the culturally adapted and reliability-tested Turkish version of the EORTC QLQ-C30 (European Organisation for Research and Treatment of Cancer – Quality of Life Questionnaire Core 30), ensuring appropriateness for the target population (10). Performance status was determined using the validated Turkish versions of the Eastern Cooperative Oncology Group Performance Status (ECOG-PS) and the Karnofsky Performance Scale (KPS), which are widely applied in oncology settings (11, 12). Pain severity was measured on a 0–10 Visual Analog Scale (VAS), where higher scores indicate greater pain intensity.

Participants' comorbid conditions were evaluated using the Charlson Comorbidity Index (CCI), which is widely applied in clinical research (13). Fatigue was measured using the Checklist Individual Strength (CIS-20), which has been validated and shown to be reliable in Turkish populations as an effective tool to assess fatigue symptoms (14).

Ethical approval for this non-interventional study was granted by the Ethics Committee for Scientific Research of SBÜ Gülhane Training and Research Hospital, under decision number 2025/122, dated June 12, 2025. All procedures adhered to the ethical standards outlined in the Declaration of Helsinki and its subsequent revisions.

Statistical analysis

Statistical analyses were conducted using IBM SPSS version 25.0 (SPSS Inc., Chicago, IL, USA). The assumption of normality was evaluated with the Shapiro-Wilk test, while homogeneity of variances was assessed with the Levene test. Descriptive statistics were presented as mean ± standard deviation and median (min–max) for continuous variables, and as frequency (%) for categorical variables. The Kruskal-Wallis test was used to compare grip strength across different lymphedema stages, with Dunn-Bonferroni post-hoc pairwise comparisons applied in cases of statistical significance. Additionally, median differences between right and left hand grip strength were evaluated using the Wilcoxon signed-rank test." And associations between variables were examined with Spearman's correlation test. A p-value of <0.05 was considered statistically significant.

RESULTS

The demographic and clinical characteristics of geriatric lymphedema patients — including age, lymphedema and disease stages, and comorbid conditions — are summarized in Table 1. A history

Table 1. Descriptive Characteristics of Patients by Age, Lymphedema Stage, Disease Stage, and Comorbidity

	n=50
Age (years) *	72.58 ± 9.53
Lymphedema stages	
Stage 1	13 (26%)
Stage 2	28 (56%)
Stage 3	8 (16%)
Breast Cancer Stage	
Stage I	0 (0%)
Stage IIA	3 (6%)
Stage IIB	4 (8%)
Stage IIIA	15 (30%)
Stage IIIB	11 (22%)
Stage IIIC	12 (24%)
Stage IV	5 (10%)
Diagnosis year*	5.30 ± 3.95
Comorbidity	
Low	27 (54%)
Medium	18 (36%)
High	5 (10%)

Descriptive statistics were shown as * mean ± SD

of radiotherapy was identified in 40 patients (80%), while 14 patients (28%) had previously received hormone therapy. Overall, 42 patients (84%) had a history of or were currently receiving hormone therapy, and in 54% of the cases, hormone therapy was ongoing at the time of evaluation. Lymphedema was observed on the left side in 26 patients (52%) and on the right side in 24 patients (48%), with all patients having right-hand dominance(15).

In older adults with lymphedema, grip strength was significantly lower on the affected side compared to the non-affected side. The median grip strength on the affected limb was 8.0 kg (range: 3–21), whereas it was 16.5 kg (range: 10–29) on the non-affected side ($p < 0.001$). This substantial difference highlights the functional impact of lymphedema on muscular performance, particularly in the upper extremities.

Quality of life was measured using the EORTC-QLQ-C30 questionnaire, which assesses functional domains such as Global Health Status (GHS/QoL), Physical Functioning (PF/QoL), Role Functioning (RF/QoL), Emotional Functioning (EF/QoL), Cognitive Functioning (CF/QoL), and Social Functioning (SF/QoL). The assessment of fatigue was conducted with the CIS-20 questionnaire, evaluating both the overall fatigue score and its distinct subscales, including subjective fatigue, concentration, motivation, and activity. Table 2 summarizes the mean and median scores for VAS, the functional domains of the EORTC-QLQ-C30, as well as the total and individual subscales of the CIS-20 questionnaire.

The correlations between the functioning subscales of the EORTC-QLQ-C30 and affected side grip strength, fatigue, functional status, and other clinical parameters are presented in Table 3. The analysis revealed a positive correlation between grip strength on the affected side and each of the functional subscales of quality of life.

Grip strength significantly differed across lymphedema stages, as shown by the Kruskal-Wallis test ($p < 0.001$). Patients in *Stage 1* demonstrated the highest grip strength, with a median of 13.0 kg (range: 10–21). In *Stage 2*, the median grip strength was 8.0 kg(range: 3–11), and it further decreased in *Stage 3* to 5.0 kg (range: 3–8). All pairwise comparisons were statistically significant,

Table 2. Descriptive Statistics of Clinical Assessment Parameters

	Functional and Symptom-Based Assessments						
	VAS	**GHS/QoL**	**PF/QoL**	**RF/QoL**	**EF/QoL**	**CF/QoL**	**SF/QoL**
Mean (SD)	6.46 (1.69)	63.17 (18.75)	57.33 (17.56)	57.33 (21.07)	65.17 (17.87)	70.00 (21.82)	76.00 (16.55)
Median	7.00	66.67	56.67	58.34	66.67	66.67	83.33
(Min-Max)	3.0-9.0	16.67-91.67	13.33-86.67	16.67-100.00	16.67-91.67	16.67-100.00	(16.67-100.00)
CIS-20							
	Total	**Subjective Fatigue**	**Concentration**	**Motivation**	**Activity**	**Affected Size Grip Strength**	
Mean (SD)	85.68 (21.39)	33.80 (8.88)	21.30 (5.41)	17.06 (4.37)	13.54 (3,64)	8.80 (3.70)	
Median	86.0	35.5	22.0	17.0	14.0	8.00	
(Min-Max)	39-129	13-51	10-32	7-26	6-21	3-21	

Abbreviations: VAS: Visual Analog Scale; GHS/QoL: Global Health Status / Quality of Life; PF/QoL: Physical Functioning / Quality of Life; RF/QoL: Role Functioning / Quality of Life; EF/QoL: Emotional Functioning / Quality of Life; CF/QoL: Cognitive Functioning / Quality of Life; SF/QoL: Social Functioning / Quality of Life; CIS-20: Checklist Individual Strength-20; SD: Standard Deviation.

Table 3. Correlations Between Functioning Subscales of the EORTC-QLQ-C30 and Affected Size Grip Strength, Fatigue, Functional Status, and Other Clinical Parameters

Variables	Functioning Subscales EORTC-QLQ-C30					
	Global Health Status (r, p)	**Physical Functioning (r, p)**	**Role Functioning (r, p)**	**Emotional Functioning (r, p)**	**Cognitive Functioning (r, p)**	**Social Functioning (r, p)**
Age	0.07, 0.643	0.04, 0.787	0.11, 0.447	0.85, 0.559	-0.01, 0.960	0.03, 0.821
Affected side grip strength	**0.46, 0.001**	**0.30, 0.036**	**0.35, 0.014**	**0.40, 0.004**	**0.31, 0.027**	**0.48, < 0.001**
Diagnosis Year	0.26, 0.067	0.12, 0.398	0.20, 0.172	0.19, 0.192	-0.07, 0.652	0.12, 0.410
Lymphedema stage	**-0.31, 0.028**	-0.16, 0.276	-0.25, 0.084	-0.26, 0.073	-0.21, 0.144	**-0.32, 0.028**
CCI Result	**-0.62, < 0.001**	**-0.45, < 0.001**	**-0.49, < 0.001**	**-0.63, < 0.001**	**-0.67, < 0.001**	**-0.62, < 0.001**
ECOG-PS	**-0.79, < 0.001**	**-0.67, < 0.001**	**-0.63 < 0.001**	**-0.71 < 0.001**	**-0.59, < 0.001**	**-0.64, < 0.001**
KPS	**0.82, < 0.001**	**0.76, < 0.001**	**0.76, < 0.001**	**0.79, < 0.001**	**0.69, < 0.001**	**0.69, < 0.001**
Breast cancer stage	**-0.73, < 0.001**	**-0.55, < 0.001**	**-0.56, < 0.001**	**-0.59, < 0.001**	**-0.50, < 0.001**	**-0.46, 0.001**
VAS	**-0.94, < 0.001**	**-0.85, < 0.001**	**-0.86, < 0.001**	**-0.85, < 0.001**	**-0.68, < 0.001**	**-0.71, < 0.001**
CIS-20	**-0.86, < 0.001**	**-0.79, < 0.001**	**-0.83, < 0.001**	**-0.78, < 0.001**	**-0.58, < 0.001**	**-0.63, < 0.001**
Subjective Fatigue	**-0,80, < 0.001**	**-0.79, < 0.001**	**-0.82, < 0.001**	**-0.81, < 0.001**	**-0.57, < 0.001**	**-0.67, < 0.001**
Concentration	**-0.72, < 0.001**	**-0.63, < 0.001**	**-0.71, < 0.001**	**-0.70, < 0.001**	**-0.55, < 0.001**	**-0.64, < 0.001**
Motivation	**-0.87, < 0.001**	**-0.73, < 0.001**	**-0.74, < 0.001**	**-0.76, < 0.001**	**-0.59, < 0.001**	**-0.64, < 0.001**
Activity	**-0.79, < 0.001**	**-0.78, < 0.001**	**-0.85, < 0.001**	**-0.71, < 0.001**	**-0.50, < 0.001**	**-0.47, < 0.001**

Abbreviations:CCI: Charlson Comorbidity Index; ECOG-PS: Eastern Cooperative Oncology GroupPerformance Status; KPS: Karnofsky Performance Status; VAS: Visual Analog Scale; CIS-20: Checklist Individual Strength-20; EORTC-QLQ-C30: European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire-C30.

Correlation coefficients (r) and p-values shown in bold represent statistically significant results ($p < 0.05$).

with $p < 0.001$ for stage 1 vs. stages 2 and 3, and $p < 0.01$ for stage 2 vs. stage 3. These findings indicate a progressive decline in handgrip strength with advancing lymphedema stage, underlining the growing impact of the condition on upper extremity function.

DISCUSSION

Hand grip strength on the affected side was notably reduced in geriatric patients who developed lymphedema following breast cancer treatment. Research focusing on this issue in the elderly population is quite limited, highlighting the importance of these findings. Furthermore, an increase in lymphedema stage was significantly associated with a decline in grip strength, indicating a strong link between disease progression and functional deterioration.

Grip strength is considered an important indicator of overall health status in older adults. While it is often regarded as a proxy for general muscular strength, it is particularly relevant to upper extremity functions and activities (8). Grip strength not only reflects current functional capacity but also serves as a predictor of future functional status and its progression over time (8). In a study by Dodds et al., grip strength assessed during midlife in a British cohort was shown to be a significant predictor of mobility limitations and difficulties with personal care in early older age (16). In this context, our study highlights the difference in grip strength between the affected and unaffected limbs in older adults with lymphedema, offering valuable insight into potential clinical limitations that may arise as a result of this functional imbalance.

Previous research has indicated that breast cancer–related lymphedema can negatively impact not only daily functioning but also mental, emotional, social, and overall physical well-being, along with perceived quality of life (17). Building on this, our study primarily examined grip strength in lymphedema patients and found a significant reduction in the affected limbs. We also investigated the role of grip strength as a clinical indicator and its relationship to quality of life. Our findings revealed a, positive correlation between grip strength in the affected limb and all functional domains of quality of life.

Shinde et al. (18) demonstrated that grip strength progressively declined with increasing age, body mass index, and lymphedema stage in individuals aged 40 to 80 years. However, their study encompassed a broader age range and did not specifically target the geriatric population. In contrast, the present study focused specifically on individuals aged 65 and older, comparing grip strength between the affected and unaffected limbs in this geriatric population with lymphedema. It also examined how grip strength varies across different lymphedema stages, offering insight into the relationship between lymphedema progression and hand grip strength. The grip strength measurements were lowest in stage 3 and significantly differed across all pairwise comparisons of lymphedema stages. Notably, our findings provide valuable insight into the association between lymphedema stage and grip strength in the geriatric population, a topic that has received limited attention in the existing literature.

In our study, we identified correlations between affected-side grip strength and all functional subscales of quality of life. Grip strength is recognized as a useful biomarker for evaluating overall health status in older adults (8). Consequently, it stands out as a particularly valuable parameter for assessing quality of life and various health outcomes in the geriatric population.

Fatigue is a common and burdensome symptom among onco-geriatric patients, significantly compromising their quality of life (19). Around 34% of breast cancer survivors continued to experience notable fatigue even 5–10 years after their diagnosis, aligning with the prevalence rates observed within

the first 1–5 years following diagnosis (20). In elderly patients, the incidence of fatigue of any grade associated with letrozole has been reported to reach up to 45% (19). In addition to our primary objective, this study also explored the relationship between fatigue—a highly prevalent and clinically significant symptom among older adults—and quality of life through clinical parameter analyses. Notably, strong and very strong correlations were identified between fatigue scores and all functional subscales of quality of life, emphasizing the significant impact of fatigue on quality of life in this population. Assessing fatigue in patients and conducting comprehensive analyses to detect potential contributing factors at an earlier stage could help improve their quality of life.

The handheld dynamometer offers a simple, reliable, and non-invasive method for assessing grip strength, making it especially suitable for use in older adults. Its user-friendly design allows for quick application in clinical settings without causing discomfort or fatigue—an essential consideration in geriatric care. When applied in the context of lymphedema, this tool enables early detection of strength deficits that may otherwise go unnoticed. Identifying these changes in the early stages provides a critical opportunity for timely intervention, which may help prevent further functional decline and support better quality of life in aging individuals.

One of the main limitations of this study is its retrospective design, which precluded post-treatment assessments and follow-up. Additionally, the lack of standardized intervention protocols and longitudinal data limits drawing causal inferences. Future prospective observational studies incorporating both pre- and post-treatment assessments and long-term follow-up are warranted to better understand the dynamics between lymphedema, fatigue, and quality of life in geriatric patients. Such research would also help identify modifiable factors and guide more targeted, effective interventions tailored to this vulnerable population.

CONCLUSION

This study highlights the impact of lymphedema on upper extremity function, fatigue, and quality of life in geriatric patients. The progressive decline in grip strength with advancing stage and its correlation with functional domains underscore the need for early recognition and targeted interventions. Comprehensive assessment of physical and clinical parameters may help guide more effective strategies to preserve independence and improve well-being in this vulnerable population.

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