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# THE RELATIONSHIP BETWEEN DISEASE VARIABLES, PAIN COPING, AND FUNCTIONAL STATUS OF PATIENTS WITH LOWER EXTREMITY LYMPHEDEMA

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*ABSTRACT*

*The purpose of this study is to investigate the relationship between reported symptoms, functional outcomes, and pain coping mechanisms in participants with lower limb lymphedema. This research has been designed as cross-sectional. Participants' age, sex, height, weight, pain, tightness, and stiffness levels reported by the participants were documented with a 10 cm visual analogue scale. The Pain Coping Inventory scale has been used to evaluate coping strategies. Functional status was measured with timed-up-and-go test (TUGT), six-minute walk test (6MWT), and quadriceps muscle strength measurement with a hand-held dynamometer. The functional outcomes were also measured in a healthy control group. The difference in muscle strength in both lower extremities was evaluated using the t-test, and the correlations were assessed using the Spearman correlation test. Twenty-eight participants with lymphedema (PWL) and 23 controls were included in the study. Twenty-three of the PWL were female (82%). The mean age of the PWL was 54.43 ± 14.12, and the mean body mass index was 33.84 ± 6.17. There were no significant differences between the PWL and healthy controls regarding age and sex. The mean muscle strength of the affected lower extremity was 4.21 ± 1.10 kgs and was significantly lower compared to the contralateral lower extremity (6.10 ± 2.98 kgs) and control group (10.92 ± 1.25 kgs) ($p<0.05$ and $p=0.007$ respectively). In functional outcomes, TUGT was significantly worse in PWL when compared to the control group (11.17 ± 3.28 seconds vs 9.04 ± 1.33 seconds, $p=0.004$). A significant correlation was observed between the TUGT result and the level of tightness felt by the PWL ($r= 0.43$, $p=0.02$). There were significant correlations between pain coping strategies and patient reported symptoms. No correlations were found between coping strategies and functional measurements. Lymphedema disrupts the functional status of the participants, and these functional disruptions may be related to symptoms reported by the participants. The correlation between pain coping strategies and patient reported tightness may indicate that tightness may be more influential on coping with pain, but further research is needed to determine a cause-and-effect relationship.*

**Keywords:** Lymphedema, lower extremities, muscle strength, pain

*INTRODUCTION*

Lymphedema is a localized form of tissue swelling resulting from excessive retention of lymphatic fluid in the interstitial compartment and caused by impaired lymphatic drainage (1,2). It is a chronic disease and it is esti-

mated to affect 1.33 per thousand people (3) with lower extremity lymphedema accounting for 80% of all cases. Although lymphedema can be seen in both sexes and at any age, it is more common in women (4) and it is unilateral in two-thirds (5). Pain, stiffness, and tightness are commonly felt in the affected area, and both skin infections and ulcerations can develop (6). These symptoms may cause a severe decrease in participants' mobility and quality of life (7). Lower extremity lymphedema in particular is a progressive disease that significantly affects the quality of life of individuals. Besides physical problems, it may cause psychosocial and emotional problems in participants (8). Appropriate physical therapy and rehabilitation programs should be applied to minimize physical problems, and psychological support methods should also be used when necessary.

Loss of function has been found in the vast majority of participants in studies conducted on participants who developed lymphedema after mastectomy although no significant difference was found in the muscle functions of the participants' upper extremities affected and unaffected by lymphedema (7). However, these parameters and their relationship with functional outcomes have never been explored in participants with lower limb lymphedema. The relationship between lower limb lymphedema symptoms such as tightness, stiffness and pain and functional outcomes in participants are also still unclear.

Pain is an especially significant concern in all participants with lymphedema, and trying to cope with it causes a substantial burden in the daily lives of the participants. There are various strategies for coping with pain. The most traditional distinction about dealing with pain is active and passive coping. Active coping methods correspond to how people manage their pain, maintain their functionality, and reduce the severity of the pain. On the other hand, in passive coping methods, people often do not believe that they can affect their pain (9). Active and passive coping methods can lead to positive or negative effects on pain management, depending on the situation and frequency of use. Prior studies emphasized the association of passive methods (e.g., withdrawal, avoidance, anxiety, rest) with adverse health outcomes such as decreased physical functioning and increased psychological stress (10). It has been previously reported that participants with lymphedema who use passive methods may have a greater amount of dysfunction, but the evidence is not specific for participants with lower limb lymphedema (11). Moreover, the investigation about coping strategies were not usually focused on pain in this population. A general approach for coping with lymphedema was investigated in the previous literature without focusing on participants with lower limb lymphedema (12-14). Therefore, more data is required to understand the relationship between functional parameters, symptoms and pain coping mechanisms in this patient population.

This study aimed to find the functional status of the affected lower extremity by measuring muscle strength with a dynamometer and both the timed-up-and-go test (TUGT) and six-minute walk test (6MWT) in participants with lower extremity lymphedema and controls and then to determine the relationship between the disease variables pain, tightness, and stiffness levels in the participants with lymphedema. In addition, we also investigated the relationship between pain coping mechanisms and functional outcomes of the participants with lymphedema.

## *MATERIALS AND METHODS*

The study is a cross-sectional study. Participants who applied to Marmara University Pendik Training and Research Hospital Physical Medicine and Rehabilitation outpatient clinics and followed up with lymphedema in the lower extremities were included. Ethics committee approval was obtained, and all participants provided written and verbal informed consent. The study was conducted according to the Helsinki Declaration.

Participant’s age, gender, height, weight, and the primary etiology of lower extremity lymphedema were recorded. A questionnaire consisting of 32 questions was provided to the

participants. The questionnaire included sociodemographic questions and specifically participants' pain, tightness, and stiffness levels. These were rated using a Numeric Rating Scale (NRS) of 1 to 10, 10 being the worst. In the last part of the form, pain coping inventory (PCI) was used.

The original form of PCI was developed by Kraaimaat et al and assesses how often participants with chronic pain use behavioral and cognitive methods to cope with pain (15). It has been translated and validated in Turkish (16). The PCI consists of 22 items, including active and passive coping methods, consisting of cognitive and behavioral components. It includes six sub-dimensions: distraction, pain transformation, comforting thinking, worrying, resting, and withdrawal. The internal consistency coefficients of the sub-factors were calculated as 0.76 for “distraction”, 0.77 for “pain transformation”, 0.53 for “comforting thinking ", 0.69 for "worrying", 0.73 for "resting," and 0.61 for "withdrawal”. Participants answered the situations in the statements using a four-item Likert-type scale. For each item, they chose one of the answers "1: Almost never, 2: Sometimes, 3: Often, 4: Very often".

Bilateral quadriceps femoris muscle strength was measured in our patient group using a dynamometer. For Quadriceps strength measurement, the test was started when the participants were sitting on a flat surface with their hips and knees flexed at 90º, their feet free and without support. Participants were verbally informed about the application technique of the test before starting the test. The dynamometer was placed perpendicular to the leg so that it was 1-2 cm above the level of the malleoli. The "make test" technique, which requires isometric contraction, was used during the test (17). (Make test is the protocol of applying maximum force against the device by the person being measured while holding the dynamometer steady).

In this study, "TUGT" and "6MWT" were used to measure the functional status of the participants. TUGT is a practical test in which dynamic balance, walking speed, and mobility can be assessed quickly. The test's application method is to get up from the chair, go 3 meters forward and come back and sit on the chair again (18). The purpose of the test is to measure the time it takes for an individual to complete this process. After telling the patient to start the test, the chronometer was started and ended when the test was finished. Walking aids such as canes were allowed during the test. During the test, certain commands were given to the patient. These commands were in order: "When I say ready to start, you will get up from the chair. You can use your hands while standing up or sitting. When you get up, you will walk to the finish line as quickly as possible, but most safely and comfortably. Both of your feet should cross the finish band. After you pass the finish tape, you will turn around, return to the chair in the same manner, and sit down. ‘The 6MWT is based on the patient walking for 6 minutes in a corridor of a certain length, where the start and end points are marked (19). The participants were guided to walk back and forth in a 30-m-long corridor. The total walking distance in meters was recorded.

*Statistical Analyses*

Considering a difference of muscle strength with an effect size of 0.7 between participants and healthy subjects, 26 subjects were planned to be allocated to participants and a control group to reach a power of 80% with a 5% error margin. However, 28 participants and 25 controls were included in our study. Sociodemographic data were evaluated with simple descriptive analyses. Percentages and means were used in descriptive analyses. The difference in muscle strength in both lower extremities was evaluated with the t-test, and the correlations were assessed with the Spearman correlation test. The data were analyzed with the SPSS v. 20.0 program and the values with $p<0.05$ were accepted as significant.

*RESULTS*

Twenty-eight participants and 25 controls who met the inclusion criteria were

**TABLE 1**
**Demographic and Clinical Characteristics for All Participants**

| Variables | Patient group, n = 28 | Control group, n = 23 |
|---|---|---|
| Age, year | 54.43 ± 14.12 | 51.64± 10.25 |
| BMI, kg/m$^n$ | 33.84 ± 6.17 | 30.81 ± 7.73 |
| Female n (%) | 23 (82%) | 19 (83%) |
| Cause of lymphedema n (%) | | |
| Idiopathic | 2(7) | |
| Cancer | 6(21) | |
| Previous operation | 7(25) | |
| Other reasons | 13(47) | |
| Unilateral lymphedema n (%) | 20(71) | |
| Bilateral lymphedema n (%) | 8(29) | |

**TABLE 2**
**Comparison of Muscle Strength and Mean Values (Standard Deviations) of Pain, Tightness, and Stiffness Levels in Participants**

| | Patient group n = 28 | Control group n = 23 | P value | CI (%95) | |
|---|---|---|---|---|---|
| | | | | Lower | Upper |
| Muscle strength (kg) | | | | | |
| Healthy side | 6.10 (2.98) | 10.92 (1.25) | 0.02 | -4.03 | -.43 |
| Affected side | 4.21 (1.10) | 10.92 (1.25) | 0.007 | -3.05 | -.55 |
| Timed Up and Go Test (sec) | 11.17 (3.28) | 9.04 (1.33) | 0.004 | 0.72 | 3.55 |
| 6 Minutes Walk Test (meters) | 411.79 | | | | |
| Tightness Level | 6.21 (3.00) | | | | |
| Pain Level | 5.96 (2.69) | | | | |
| Stiffness Level | 6.68 (3.08) | | | | |

accepted to participate in the study. The participants' mean (SD) age was 54.43 (14.12) years. 82% (23) of the participants were female and 18% (5) were male. The mean (SD) age of the control group was 51.6 (10.25) years, 76% (19) females and 24% (6) males.

It was observed that the mean (SD) BMI of the participants and control groups were 33.84 (6.17) and 30.81(7.73), respectively. When the participants participating in the study were asked about the causes of lymphedema, 7% (2) stated that it was idiopathic, 21% (6) cancer, 25% (7) a previous operation, 47% (13) other reasons. Unilateral lymphedema was observed in 71% (20) and bilateral lymphedema in 29% (8) of the participants.

(*Table 1*). The affected lower extremity muscle strength of the participants was significantly lower when compared to the healthy side and control group; 4.21 (1.10) kg, 6.10 (2.98) kg vs. 10.92 (1.25). In addition, the TUGT results of participants (11.17 (3.28)) significantly higher than the control group (9.04 (1.33) (*Table 2*).

A positive and significant relationship was found between the TUGT and the feeling of tightness (rho = 0.430, p = 0.022). The withdrawal, one of the passive sub-dimensions of the PCI, was found to be significantly related to the tightness (rho= .482, p = 0.009) (*Table 3*) and stiffness levels (rho = 0.427, p = 0.023). A significant and positive relationship was found between the tightness level and the

**TABLE 3**
**Correlations Between Tightness, Pain, and Stiffness Levels for Participants with Lymphedema (n=28)**

| | Median (SD) | Timed Up and Go Test | Tightness Level | Pain Level | Stiffness Level |
|---|---|---|---|---|---|
| Timed Up and Go Test | 11.18 (3.29) | – | 430* | 0.291 | 0.343 |
| Tightness Level | 6.21 (3.0) | | – | 0.767** | 0.806** |
| Pain Level | 5.96 (2.70) | | | – | 0.604 |
| Stiffness Level | 6.68 (3.10) | | | | – |

**TABLE 4**
**Correlations Between Pain, Stiffness, and Tightness with Pain Coping Inventory Components for Participants with Lymphedema (n=28)**

| | Median (SD) | Distraction | Pain Transfor-mation | Comforting thinking | Worrying | Resting | Withdrawal |
|---|---|---|---|---|---|---|---|
| Pain Level | 5.96 (2.70) | 0.219 | -0.283 | 0.335 | 0.185 | 0.358 | 0.482** |
| Stiffness Level | 6.68 (3.08) | 0.219 | -0.047 | 0.252 | 0.053 | 0.154 | 0.427* |
| Tightness Level | 6.21 (3.0) | 0.450* | -0.157 | 0.393* | 0.191 | 0.332 | 0.484** |
| Distraction | 9.0 (1.97) | – | 0.129 | 0.572** | -0.019 | 0.139 | 0.088 |
| Pain Trans-formation | 3.89 (2.11) | | – | 0.153 | -0.502** | -0.422* | -0.160 |
| Comforting thinking | 8.07 (2.20) | | | – | 0.046 | 0.095 | 0.297 |
| Worrying | 9.42 (3.85) | | | | – | 0.640** | 0.353 |
| Resting | 17.5 (4.26) | | | | | – | 0.456* |
| Withdrawal | 11.18 (2.68) | | | | | | – |

distraction, comforting thinking, and withdrawal sub-dimensions of the PCI (*Table 4*). A significant and positive relationship was found between the TUGT and worrying (rho = 0.413, p = 0.029) and resting sub-dimensions of the PCI rho = 0.385, p = 0.043). A significant and negative relationship was found between the 6-MWT and the resting and withdrawal sub-dimensions of the PCI. (rs = -0.466, p = 0.012) (rs = -0.445 p = 0.018). No significant correlation was found between muscle strength of the lower extremity with lymphedema and the sub-dimensions of the PCI (p>0.05).

*DISCUSSION*

The significant findings of this study were reduced muscle strength in the affected lower extremity of participants with lower extremity lymphedema compared to the healthy counterparts and significantly poorer TUGT results compared to the control group. Also, a significant and negative relationship was found between muscle strength in the affected lower extremity and TUGT results. However, any significant relationship was not found between muscle strength and 6MWT. Regarding the relationship between the lymphedema-related symptoms and functionality, only the level of tightness felt by the participants was significantly and positively corre-

lated with the TUGT results. As expected, in our study, the TUGT results indicated that the functional status of participants with lower extremity lymphedema were significantly poorer than those of the control group which mirrors studies performed in the upper extremity. In a previous study by Park et al on participants with upper extremity lymphedema, function reductions were observed in the extremity affected by lymphedema (20). Orhan et al found a significant difference between the severity of lymphedema and the functional status of the upper extremity (21).

Although no significant relationships were found between the muscle strength and PCI subdimensions, there were significant relationships between 6MWT and the resting and withdrawal sub-dimensions and between TUGT and the worrying and resting subdimensions. These findings suggest that some participants' responses to pain affected the results of the 6MWT and TUGT, which express the daily functionality. From these results, it can be deduced that participants' responses to pain affect their functionality in various ways. 67.8 percent of the participants who participated in our study were between the ages of 18-65 and were classified as young according to the WHO age scale. In this age range, which is expected to be highly productive for the individual and society, the daily functionality and productivity of the participants decrease due to lower extremity lymphedema. This situation is extremely negative for the individual as well as the society. In the study conducted by Erdoğanoğlu et al, it was found that there was no significant loss of function in the lower extremities of the participants due to fear of movement (7). On the contrary, in our study, a significant relationship was found between worry, which is a passive coping strategy, and the results of the TUGT. Additionally, our study found a significant relationship between withdrawal, one of the PCI's sub-dimensions, and all disease variables. Problems such as decreased self-confidence, depression, anxiety, and sleep problems may occur in participants whose daily functioning is affected, as shown by previous studies (8). However, the exact impact of this loss of function in the participants' daily lives should be determined by further investigation.

Nociceptive pain characteristics of participants with lymphedema may include symptoms such as pain, heaviness, stiffness, and tightness (22). Therefore, the relations of these symptoms with PCI parameters were evaluated in this study and the levels of pain and stiffness were found to be correlated with withdrawal sub-dimension of PCI. On the other hand, a significant and positive relationship was found between the level of tightness and the PCI sub-dimensions: distraction, comforting thinking, and withdrawal. When considering that only the tightness sensation was found to be related to functionality, it can be concluded that the participants have more disability and resort to coping methods more when the tightness level increases rather than the pain and stiffness sensation. Nevertheless, it is noteworthy that the withdrawal sub-dimension of PCI was significantly associated with all three disease symptoms. This suggests that withdrawal is the common coping method participants use when facing disease variables such as pain, stiffness, and tension.

To the best of our knowledge, this is the first study to investigate the relationship of functional parameters and participants' clinical condition in participants with lower extremity lymphedema. However, the study's cross-sectional nature, the limited patient population for correlation analyses, and inclusion of participants with all kinds of etiologies for lymphedema can be considered among the study's limitations.

## *CONCLUSION*

At the beginning of our study, we hypothesized that lower extremity functional status of the participants with lymphedema determined with 6MWT, TUGT, and quadriceps femoris muscle strength measurements would be adversely affected by the increase in disease variables such as pain, stiffness, and tension. Quadriceps femoris muscle strength in participants with lower extremity lymphedema is significantly less in the affected lower extremity. However, we found no correla-

tion between disease variables and functional status, except for the correlation between the tension level felt by the participants and the TUGT result.

## *CONFLICT OF INTEREST AND DISCLOSURE*

All authors declare no financial conflicts of interest.

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