Effects of Physiotherapeutic Exercises on Quality of Life in Patients with Chronic Kidney Disease

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Abstract

Background: The cardiopulmonary capacity, muscle strength, functional capacity and psychological well-being are reduced in the patients with Chronic Kidney Disease (CKD). The purpose of this study was to determine the effects of aerobic and strengthening exercises combined with breathing exercises on muscle strength, functionally independent, quality of life and depression in patients with CKD.

Methods: 20 patients (12 men and 8 women) with aged between 37 and 65 years were included in the study. Demographic information, posture analysis, respiratory function, muscle shortness and muscle strength were evaluated. Beck Depression Inventory was used evaluate psychological state. Additionally, Short Form-36 (SF-36) and The Functional Independence Measure (FIM) scale were used to obtain the health and functional level of the patients with CKD.

Results: We observed statistically significant improvement in vitality, general health status, physical functioning and pain scores of SF-36. The degree of depression decreased significantly after the treatment (p=0.000). There was statistically significant improvement in saturation level and axillar circumference measurement (p<0.05). The significant difference was found in shoulder extension, knee flexion and hip abduction (p<0.05).

Conclusion: Respiratory therapy and resistance exercises could improve muscle strength, quality of life, saturation level and axillar circumference measurement and decrease depression level in patients with CKD.

INTRODUCTION

Patients with chronic kidney disease (CKD) have many comorbidities, which is the leading cause of morbidity and mortality [1]. Cardiovascular conditions take an important part in that disease [2,3]. Also, both of complications of dialysis and uremia-specific factors contribute to increased cardiovascular risk in this population [4].

Most patients with CKD are physically inactive and they typically lead sedentary lifestyles [4,5]. Generally, they have impaired exercise capacity, reflected in reduced values of peak exercise oxygen uptake (VO2). Exercise capacity is the range of physical activities a patient can do, decrease in exercise capacity can ultimately effect on main activities of independent living [6]. Patient who have CKD have a demonstrated decrease in cardiorespiratory fitness, muscle force, physical performance and therewithal they may contribute to emotional and social problems that result in various impairments and functional limitations [1,7].

In related studies, aerobic exercise has been shown to be improved quality of life, decreased depression, and decreased anxiety in CKD patients. It also increases maximum aerobic capacity, decreases blood pressure, increases hematocrit/hemoglobin, decreases triglycerides, increases HDL, and increases insulin sensitivity [8].

Understanding the effect of chronic illness and associated treatment on functioning and well-being in physical, social and mental dimensions life is essential and, working to incorporate quality of life into medical care outcome studies are increased. So...
the purpose of this study was to determine the effects of aerobic and strengthening exercises combined with breathing exercises on muscle strength, quality of life and depression in patients with chronic kidney disease.

**MATERIAL AND METHODS**

We evaluated 20 patients (12 men and 8 women) with Chronic Kidney Disease (CKD) aged between 37 and 65 years. This study is based on a prospective analysis of a physical exercise program targeted to CKD patients. The study was carried out after approval from the Ethics Committee of the Mustafa Kemal University and obtaining a signed informed consent from the patients whom were volunteer to participate in the study.

**Patients**

The inclusion criteria were ages between 35 and 65 years, could walk and with no rheumatic and orthopedic diseases that could prevent them from following the proposed protocol; the patients were also required to have the cognitive capacity to answer the study questionnaire. In addition, the participants were suffering from renal insufficiency. Patients who hold postoperative renal transplantation and abdominal surgery of the upper or lower abdomen were excluded.

The assessment protocol consisted of medical history and general clinical status (neurological, hemodynamic, respiratory and musculoskeletal assessments) following this outcomes functionality, exercise capacity, respiratory depth was collected. Chest circumference measurement was made in inhalation and exhalation from axillary, subcostal, and xiphoid area. The participants were also assessed before and after the treatment program, through the generic Medical Outcomes Study Short-Form 36 (SF-36) questionnaire, SpO2, heart rate, depression level with Beck depression inventory. Lower and upper extremities, neck muscles strength were assessed with manual muscle test.

Functional Independent Measurement was used to evaluate the physical and cognitive disability level of the patients. Items are scored on the level of assistance required for an individual to perform activities of daily living. Possible scores range from 18 to 126, with higher scores indicating more independence. Alternatively, 13 physical items could be scored separately from 5 cognitive items.

Beck Depression Inventory is a series of questions developed to measurement the intensity, severity, and depth of the depression. Its long form is composed of 21 questions, each designed to assess a specific symptom common among people with depression. For the general population, a score of 21 or over represents depression.

The Short Form-36 is one of the most widely used generic measures of health-related quality of life. There is no single overall score for the SF-36, instead. It generates 8 subscales. The 8 subscales are physical functioning, role limitations due to physical problems, bodily pain, general health perceptions, vitality, social functioning, role-limitations due to emotional problems and mental health.

**Procedure**

Respiratory therapy and resistance exercises with therebant for upper extremities, lower extremities and neck muscles were applied for 4 weeks 3 times in a week 1 hour per session. In rehabilitation program, the respiratory therapy included assisted cough and breathing exercises (diaphragmatic and abdominal breathing, breath control and maximum sustained breath) combined with the active movement the upper limbs. The program that was offered to the patients included active or resistive exercises for shoulder abduction, elbow flexion, wrist extension, hip flexion, knee extension and ankle dorsiflexion combined with respiratory exercises. There band and 1 kg dumbbell were used for resistance. Each exercise was done maximally one set of 10 repetitions.

Statistical Analyzes: Pre-treatment and post-treatment differences were analyzed with Wilcoxon Test. The characteristics of the study sample are described by mean and standard deviation for continuous variables, median and minimum-maximum for ordinal variables.

**RESULTS**

Twenty patients who met the criteria volunteer to participate and signed the informed consent included to study. Two patients were dropped out and one refused to continue.

Eight women (40%), aged between 39 and 64 years (51.37 years) and 12 men (60%), aged between 37 and 65 years (51.58 years) participated. We recorded them that 45% of the patients were diagnosed with heart failure, 55% had hypertension, 30% had diabetes mellitus. The results of the analysis of the SF-36 questionnaire domains before and after physical therapy intervention were shown in Table (1).

We observed statistically significant improvement in vitality, general health status, physical functioning and pain scores of SF-36. While the independence level did not change (p>0.05), the degree of depression decreased significantly after the treatment (p=0.000, Table 1).

Pre and post-treatment chest circumference measurements and SpO2 results were shown in Table (2). There were no significant differences in breath type, the symmetry of ventilation, accessory pulmonary muscles’ activity and respiratory frequency (p>0.05). Statistically significant improvement was in SpO2 recorded and axillary measurement (p<0.05).

Lower and upper extremities, neck muscles strength were assessed with manual muscle test. The muscle strength was significantly increased only in shoulder extension, knee flexion and hip abduction (Table 3).

**DISCUSSION**

Results of our study were showed that physical exercises that done regularly brought an improvement in some parameters such as quality of life, functional mobility and oxygen saturation, a decrease in depression level.

It was remarked in the literature the cardiopulmonary capacity, muscle strength, and functional capacity, psychological situation is reduced in the patients with CKD. Exercise is one...
of protective approaches that reduce muscle protein loss or muscle function muscle function. Exercise has a direct stimulating effect on synthesizing speed of muscle proteins ad also disturbs the balance between synthesis and destruction in favor of destruction Because of these problems, the rehabilitation program is very important in the treatment of the patients with CKD [13,14]. Some studies expressed that participating in a pre-conditioning exercise activities with low-to-moderate intensity showed beneficial effects on behavioral change, physical fitness, physiological conditions and quality of life [15].

There is a fact that physical activity enhanced the quality of life (QoL) as a benefit of and motivator for lots of patients with kidney disease [16].

Segura-Ortí et al., (2009) reported that 24 weeks resistance training during hemodialysis could improve exercise capacity, muscle strength, physical functioning and health-related quality of life compared to a low-intensity aerobic program [17]. Contrary to this study, we found that 4 weeks exercise program combined with respiratory therapy decreased depression level and improved muscle strength and quality of life.

Painter et al., found significant effects of exercise in peak oxygen uptake measurements and in self-reported physical functioning as measured by the Short Form-36 questionnaire [18]. We observed statistically significant improvement in vitality, general health status, physical functioning and pain scores of SF-36. There was statistically significant improvement in Spo2 values and quality of life parameters in our study (p<0.05).

In our study there was significant improvement in axillar chest circumference measurement after the treatment than initial values. Pinto et al., stated that respiratory capacity and strength respiratory muscle improved after pilates exercises [19].

Depression is one of the most important disorders in chronic kidney disease patients. The patient’s age, ethnicity, medical status and perception of quality of life effects the level of depression in CKD patients. In many studies exercise training

### Table 1: Pre and post-treatment levels of depression, dependence and quality of life.

<table>
<thead>
<tr>
<th></th>
<th>Pre-Treatment</th>
<th>Post-Treatment</th>
<th>p</th>
<th>z</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-36 Physical Functioning</td>
<td>35.75 ± 32.00</td>
<td>38.72 ± 31.57</td>
<td>0.003</td>
<td>-2.937</td>
</tr>
<tr>
<td>Emotional Role</td>
<td>43.30 ± 48.49</td>
<td>43.31 ± 46.49</td>
<td>0.068</td>
<td>-1.826</td>
</tr>
<tr>
<td>Social Function</td>
<td>58.12 ± 25.73</td>
<td>58.75 ± 25.68</td>
<td>0.317</td>
<td>-1.000</td>
</tr>
<tr>
<td>Vitality</td>
<td>40.50 ± 20.25</td>
<td>42.66 ± 20.88</td>
<td>0.033</td>
<td>-2.138</td>
</tr>
<tr>
<td>General health status</td>
<td>39.75 ± 13.10</td>
<td>43.55 ± 12.82</td>
<td>0.002</td>
<td>-3.025</td>
</tr>
<tr>
<td>Mental health</td>
<td>68.20 ± 14.53</td>
<td>67.49 ± 13.87</td>
<td>0.157</td>
<td>-1.414</td>
</tr>
<tr>
<td>Bodily Pain</td>
<td>46.80 ± 28.33</td>
<td>51.95 ± 25.62</td>
<td>0.020</td>
<td>-2.320</td>
</tr>
<tr>
<td>Role Physical</td>
<td>20.00 ± 28.79</td>
<td>23.75 ± 27.47</td>
<td>0.083</td>
<td>-1.732</td>
</tr>
<tr>
<td>Functional Independent Measurement</td>
<td>117.90 ± 6.91</td>
<td>118.05 ± 6.93</td>
<td>0.180</td>
<td>-1.342</td>
</tr>
<tr>
<td>Beck Depression Inventory</td>
<td>16.70 ± 6.43</td>
<td>14.50 ± 5.92</td>
<td>0.000</td>
<td>-3.763</td>
</tr>
</tbody>
</table>

*p<0.05, X: Mean; SD: Standart Deviation

### Table 2: Difference in chest circumference measurement and respiratory parameters.

<table>
<thead>
<tr>
<th></th>
<th>Pre-treatment</th>
<th>Post-Treatment</th>
<th>p</th>
<th>z</th>
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</thead>
<tbody>
<tr>
<td>Axillar</td>
<td>2.95 ± 0.82</td>
<td>3.70 ± 0.92</td>
<td>0.001</td>
<td>-3.419</td>
</tr>
<tr>
<td>Subcostal</td>
<td>2.75 ± 0.85</td>
<td>2.7500 ± 0.85</td>
<td>1.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Xiphoid</td>
<td>3.35 ± 0.81</td>
<td>3.3500 ± 0.81</td>
<td>1.000</td>
<td>0.000</td>
</tr>
<tr>
<td>SpO2</td>
<td>95.40 ± 2.11</td>
<td>96.10 ± 1.71</td>
<td>0.012</td>
<td>-2.500</td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td>22.35 ± 1.59</td>
<td>22.40 ± 1.31</td>
<td>0.839</td>
<td>-0.203</td>
</tr>
</tbody>
</table>

*p<0.05, X: Mean; SD: Standart Deviation; SpO2: Oxygen Saturation

### Table 3: Difference in muscle strength.

<table>
<thead>
<tr>
<th></th>
<th>Pre-Treatment</th>
<th>Post-Treatment</th>
<th>p</th>
<th>z</th>
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</thead>
<tbody>
<tr>
<td>Shoulder Extension</td>
<td>4(3-5)</td>
<td>5(4-5)</td>
<td>0.046</td>
<td>-2.000</td>
</tr>
<tr>
<td>Hip Abduction</td>
<td>4(3-5)</td>
<td>5(3-5)</td>
<td>0.008</td>
<td>-2.646</td>
</tr>
<tr>
<td>Knee Flexion</td>
<td>4(3-5)</td>
<td>5(3-5)</td>
<td>0.025</td>
<td>-2.236</td>
</tr>
</tbody>
</table>

*p<0.05
appears to have a rejuvenating effect decreasing depression levels in CKD patients. Andrade and Seseo 2012 declared decrease in depression level after conservative treatment like our exercises program. Carmark et al.,1995 hypothesized that increase aerobic capacity would be related to decreasing the level of psychological distress, depression, anxiety in patient with chronic kidney disease [20-23]. Our treatment program succeeds to decrease depression level in CKD patients.

Patients with CKD are characterized by decreased levels of physical functioning, as a result of low physical activity [23]. Cowen et al., Studied to examine and compare the results of alteration the functional independence of CKD patients before and after the rehabilitation program. They (1995) stated that they used FIM in their studies to examine admission and discharge [24]. We used FIM to investigate independence but we could not found significant improvement in independence level (p>0.05).

There was statistically significant improvement in Spo2 and axillary measurement (p<0.05) after the treatment in our study. Pellizzaro et al., (2013) assessed respiratory strength, functional capacity in patients with hemodialysis and found that respiratory muscle training improved functional capacity significantly [25].

Lima et al., (2013) studied to found the effect of exercise performed during hemodialysis: strength versus aerobic exercises performed during hemodialysis (HD) in individuals with chronic renal disease in 8 weeks. Improvement in the maximal inspiratory pressure, number of steps achieved, and quality of life were the main results of the study [26]. Contrary to this study we found that quality of life could improve in 4 weeks.

Howden et al., (2013) studied to find effects of exercise and lifestyle intervention on cardiovascular function in chronic kidney disease. They reported that exercise training and lifestyle intervention in patients with CKD causes improved in CKD body composition, and diastolic function [27]. In our study, we observed that exercise could improve the quality of life although we did not contain the lifestyle intervention into the study.

In our study, it was founded that just in shoulder extension, knee flexion and hip abduction muscle strength increased significantly (p<0.05). Nankaku et al., (2016) declared that the hip external rotator exercise program was performed 5 times per week for four weeks for their exercise group, and one of the outcome measures was muscle strength of lower extremity. Exercise program which performed four weeks like our study could not obtained significant improvement in muscle strength of lower extremity.

Hevey et al.,(2003) founded that four-week multidisciplinary cardiac rehabilitation had similar improvements in exercise capacity and quality of life as 10-week programs. Exercise program improved exercise capacity and general health and well-being and no significant differences were detected between groups undergoing a 10 or 4-week rehabilitation program [29].

When we reviewed the literature we noticed that there was a broad range of difference in the duration of the rehabilitation programs. Our study was for four weeks. A significant effect of increasing in the quality of life in 4 weeks was declared same results but in more time in some studies like our study [29].

We concluded four weeks was enough to achieve improvements in physical activity on quality of life. The studies state more than four-week is needed to get improvements in physical and social function, general health status. Besides this, we found that exercise program with 3 times in a week for four weeks had significant effects, especially on the psychological situation.

CONCLUSION

It is confirmed that exercise interventions are effective in delaying CKD progression and/or decrease mortality, the potential impact of such interventions for public health would be enormous. So exercises are very important and rehabilitation programs are effective in daily living for the patient all the times.

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REFERENCES