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Original Research Article

Efficacy of Pilates Exercises in Improving Pulmonary Functions and Quality of Life after Renal Transplantation: A Randomized Controlled Trial

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ABSTRACT

Objective: The aim of the study was to evaluate the efficacy of pilates exercises program in improving quality of life and pulmonary functions after Renal Transplantation.
Methods: Forty subjects were randomly divided into control group (C) and pilates group (P).Patients in control group received only medical care while pilates group received pilates exercises program. Pulmonary functions and quality of Life score were evaluated one day before surgery, 3rd day & 3 weeks post operatively for all patients.
Results: The results of the study showed that there were significant improvement in QOL score , FEV1& FEV6 in pilates group more than control group (p value <0.05).
Conclusion: It was concluded that pilates exercises program is effective in improving quality of life and pulmonary functions in post renal transplantation patients.

Key words: Pulmonary function, Renal transplantation, Pilates Exercises, Quality of life.

INTRODUCTION

Chronic renal failure (CRF) is a progressive and untreatable disease which is associated with numerous complex metabolic and hormonal changes leading to a development of consequent complications which further change function of all organ systems. [1] CRF has several stages. The last one is known as the end-stage renal disease (ESRD). The renal function at this stage has to be replaced by either hemodialysis (HD) or peritoneal dialysis (PD). Such treatment is a lifesaving method but it does not completely substitute function of healthy kidney. Therefore the best solution for all patients is kidney transplantation. [2]

Patients with end-stage renal disease are characterized by severe functional limitations. Although renal replacement treatment options, such as hemodialysis (HD) or renal transplantation reduces morbidity and mortality, end-stage renal disease patients still experience significantly low physical fitness, psychosocial problems and poor quality of life. [3,4] Malnutrition, which can occur in CKD patients, persist, worsening muscle loss and predisposing to fatigue, with an increase in respiratory rate and work. The most frequent pulmonary alterations found are obstructive disorders, such as airflow limitation in distal airways and reduced pulmonary diffusion capacity. [5,6]

Rehabilitation after kidney transplantation seeks to recover the patient's physical and psychological fitness, thereby providing a satisfactory level of activity to maintain an active family, social, and professional life. [7] Pilates exercise has been used for rehabilitation purposes increasingly over the last twenty years. Pilates is named after its founder, Joseph Pilates, who developed a series of exercises in the 1920s to encourage physical and mental conditioning .The Pilates method has been used for various physiotherapy purposes, and its main purpose is to improve the health and overall body flexibility, with an emphasis on strengthening the trunk, posture and breathing. [8,9]

Deterioration of respiratory function and quality of life are the major problems in patient who underwent renal transplantation. [3] Therefore, the aim of this study was to evaluate the effect of pilates on pulmonary functions and quality of life in patients after renal transplantation.

MATERIALS AND METHODS

Subjects

Forty post-kidney transplantation patients (16 women and 24 men) were recruited. The study patients were selected from the hospitalized patients in General Teaching Hospital between July 2011 and September 2012. After the assessment of eligibility was completed, the participants signed a consent form to participate in the study. The inclusion criteria included; conscious patient, neurologically free patient, patients were free from genitourinary infections, patient were taken from both genders, their aged ranged between 40 and 60 years, patients were suffering respiratory problems post renal transplantation.

Exclusion criteria were patients with neuropathy issues, rheumatic and orthopedic diseases, patients in the immediate postoperative renal transplant and with abdominal surgery of the upper or lower abdomen will be excluded. Patients who require acute respiratory intervention, who require intensive medical support and are transferred to the intensive care unit. Active smokers, Diabetics, patients with chronic hepatitis, patients with pacemaker were excluded.

The first contact with the patients allows them to complete the evaluation form. Pulmonary functions and Quality of Life were evaluated one day before surgery, 3rd day & 3 weeks post operatively for all patients. After evaluation, subjects were randomly divided into control group (C) and pilates group (P). For each subject, the researcher will take a sealed opaque envelope from a box following a numerical sequence; the envelope will contain a letter indicating whether the patient will be allocated to the control or the Pilates Group. Patients in control group received only medical care (analgesics, antibiotics, wound care) while pilates group received pilates exercises program once a day, 5 days / week for 3 weeks in addition to already taken medical care.

Measurement procedures

Measurement the Quality of life

The World Health Organization defined quality of life as "*the individual's perception of their life status concerning the context of culture and value system in which they live and their goals, expectations, standards, and concerns*". [10] Quality of life can be assessed using both general and specific instruments. [11] Objective measures of life quality have become an adjuvant tool in the analysis of therapeutic interventions and individuals' level of satisfaction with their health and treatment. [12]

WHOQOL-BREF is an abbreviated generic Quality of Life Scale developed through the World Health Organization. WHOQOL-BREF provides a valid and reliable alternative method for assessment of quality of life. The

WHOQOL-BREF instrument comprises 26 items, which measure the following broad domains: physical health, psychological health, social relationships, and environment. Each domain was assessed separately and higher scores represented better quality of life. The WHOQOL-BREF is a shorter version of the original instrument that may be more convenient for use in large research studies or clinical trials the instrument has proved to have good discriminant validity. [13-15] Measurements were done for all patients of both groups one day before surgery, 3rd day (pre exercises) and 3 weeks post-operatively.

Assessment of pulmonary functions [16-22]

Pulmonary function tests (PFTS) are an important tool in the investigation and monitoring of patients with respiratory pathology. Spirometry is the most frequently used measure of lung function and is a measure of volume against time. It is a simple and quick procedure to perform. The normal ranges for spirometry values vary depending on the patient's height, weight, age, sex, and racial or ethnic background. An electronic spirometer is used to examine the health of lungs by measuring inspiratory volume. This means that an incentive spirometer measures how well the patients are filling their lungs with each breath. Though typically used for people recovering from surgery or with conditions such as chronic obstructive pulmonary disease (COPD) and asthma, an incentive spirometer is used by people who need to exercise their lungs.

Patients were instructed to be relaxed in a correct sitting position and patient data including (name, age, and height) were recorded in the evaluation sheet. (PFTS) are effort dependent and therefore patient cooperation and understanding in performing the tests is essential in obtaining optimal results. Patient was instructed to held incentive spirometer in an upright position and seals his lips tightly around it. Patients were advised not to eat a large meal two hours before testing and not to wear tight fitting clothing.

The variables measured were FEV1 and FEV6. The volume expired in the first second of the FVC test is called FEV1 and is a very important parameter in spirometry. This parameter is also known as the Tiffeneau index, named after the French physician that discovered the FEV1/VC ratio. The FEV6, or maximal volume of air exhaled in the first 6 s of the FVC maneuver, and The FEV1/FEV6 ratio provides accurate surrogate measure for the FEV1/FVC ratio in the interpretation of the spirometry, especially when simplified portable equipment is used. Patients were instructed on how to perform the test via demonstration of the appropriate technique. PFTS should be performed three times to ensure that the results are reproducible and accurate. Measurements were done for all patients of both groups one day before surgery, 3rd day (pre exercises) and 3 weeks post-operatively.

Treatment procedure: Before the start of the exercise program, the principles of the Pilates exercises were introduced for pilates group (P). To facilitate learning, each exercise was first performed by the researcher then by the patient. The main principles of the pilates exercises consist of constant coordination between breathing and movement, exhalation should be forced, and inhalation should be as natural as possible. Patients were trained to activate the *powerhouse,* which is the muscular center responsible for the static and dynamic stabilization of the body. [23-26]

All exercises were performed with a focus on activation of the powerhouse and balance; the joints, pelvis, and trunk; spine stabilization; body awareness; axial stretching and strengthening the abdominal muscles; upper and lower limbs. The exercises involve eccentric, concentric and

isometric contractions that mainly focus on the center of force, the power house. [27]

The patient was asked to do isometric contraction of abdominal muscles, spine extensors, hip extensors, hip flexors and deep muscles of the pelvis. Also isotonic (concentric and eccentric) contractions of the abdominal muscles, transverse abdominal muscle, multifidus muscle, and pelvic floor muscles, which are responsible for the body's static and dynamic stability, were performed. Breathing takes place simultaneously with the contraction of those structures. Examples of exercises were liberation movements of the hips, hip elevations off the bed, leg movements in circles, spin column exercises, a series of side-kicks, strengthening exercises for the upper and lower limbs with an elastic band ball. [28]

The program starts from 3rd day postoperative. The patient should perform the movements in the desired range and perform all repetitions. The exercises are adapted to the condition of the participant, and difficulty is gradually increased. The springs and pulleys can be used to make the exercises easier or more difficult. [29] Pilates program was introduced for 30 mins, twice a day, 5 days/week for 3 weeks post operatively.

Statistical analysis: Statistical analysis was performed using Statistical package for the Social Sciences (SPSS) version 20.0. Differences were assumed significant at p value <0.05. Continuous variables were presented as mean and standard deviation while categorical variables were described by frequency and percentage. Paired T-test was used to test the differences in outcome measures within group for parametric data (FEV1, FEV6) while Wilcoxon test was used to test the differences in outcome measures within group for nonparametric data (QOL measures). Independent T test was used to compare data between groups for parametric data (Age, weight, height, FEV1, FEV6) while Mann-Whitney was used to test the differences in outcome measures within group for nonparametric data (QOL measures).

RESULTS

As shown in table 1 there were no significant differences between both groups as regard to basic demographic and clinical characteristics (Age, Sex, height, weight, QOL, Initial FEV1,Intial FEV6).

As shown in table 2 there were significant reduction of QOL score, FEV1, FEV6 from one day pre-surgery to 3rd day post-operatively in each group ($p < 0.05$). Also there were no significant differences between both groups at one day- pre surgery & at 3rd day post-operatively (pre exercise program) as regard to QOL score, FEV1, FEV6 ($p > 0.05$).

Table 1: Represented initial or basic demographic and clinical characteristics of patients at baseline of treatment

Variable	Pilates Group(P) (20)	Control Group (C) (20)	P value
Age (years) (mean ±SD)	51.90±6.42	50.25±6.09	0.410*
Sex(N) % Male Female	 (14) 70% (6) 30%	 (10) 50% (10) 50%	0.206*
Height(cm) (mean ±SD)	1.67±11.22	1.73±11.75	0.122*
Weight(Kgm) (mean ±SD)	86.05±15.45	87.85±16.45	0.723*
QOL score one day- pre surgery (median ±SD)	56.50±7.58	54.50±5.11	0.704*
FEV1 one day- pre surgery (Liter) (mean ±SD)	1.39±0.083	1.38±0.085	0.864*
FEV6 one day- pre surgery (Liter) (mean ±SD)	1.62±.052	1.60±.047	0.148*
* No significant difference			

Table 2 Represented Comparative analysis of QOL, FEV1, FEV6 at one day- pre surgery & at 3rd day post-operatively (pre exercise program) between both groups.

Variable	Pilates (P) Group (20)	Control (C) Group (20)	P value between groups
QOL score at one day- pre surgery (median ±SD)	56.50±7.58	54.50±5.11	0.704*
QOL score 3rd day post-operatively (median ±SD)	43.00±6.29	41.00±5.18	0.211*
P value within group	0.002**	0.000**	
FEV1 one day -pre surgery (mean ±SD)	1.39±0.083	1.38±0.085	0.864*
FEV1 score 3rd day post-operatively (Liter) (mean ±SD)	1.15±.075	1.16±0.21	0.888*
P value within group	0.000**	0.000**	
FEV6 one day -pre surgery (mean ±SD)	1.62±.052	1.60±.047	0.148*
FEV6 score 3rd day post-operatively (Liter) (mean ±SD)	1.44±0.079	1.43±0.097	0.736*
P value within group	0.000**	0.000**	
* No significant difference * * Highly significant difference			

Table 3 represented Comparative analysis of QOL score, FEV1, FEV6 at 3rd day post-operatively (pre exercise program) &3 weeks post-operatively between both groups.

Variable	Pilates (P) Group (20)	Control (C) Group (20)	P value between groups
QOL score 3rd daypost-operatively (median ±SD)	43.00±6.28	41.00±5.18	0.211*
QOL score 3 weeks post-operatively (median ±SD)	93.00±9.27	58.00±10.59	0.000**
P value within group	0.000**	0.061*	
FEV1 3rd daypost-operatively (Liter) (mean ±SD)	1.153±.075	1.159±0.21	0.888*
FEV1 3 weeks post-operatively (Liter) (mean ±SD)	1.937±.124	1.724±.072	0.000**
P value within group	0.000**	0.000**	
FEV6 3rd daypost-operatively (Liter) (mean ±SD)	1.44±0.079	1.43±0.097	0.736*
FEV6 3 weeks post-operatively (Liter) (mean ±SD)	2.361±.148	2.225±.159	0.008**
P value within group	0.000**	0.000**	
* No significant difference * * Highly significant difference			

In control group there was improvement in QOL score from 3rd day to 3 weeks postoperatively but with no significant differences (p >0.05) while there were significant increase in FEV1& FEV6 from 3rd day to 3 weeks postoperatively (p <0.05). In pilates group there were marked increase in QOL score, FEV1& FEV6 from 3rd day to 3 weeks postoperatively (p < 0.05). When both groups were compared there were no significant differences at 3rd day post-operatively (before exercise program) as regard to QOL score, FEV1& FEV6 (p >0.05) while there were highly significant differences at 3weeks post-operatively as regard to QOL score, FEV1& FEV6 (p <0.05) (Table 3).

DISCUSSION

Results of the study showed that the level of QOL score, FEV1& FEV6 at one day pre-surgery was below normal and this reflect the impact of the end-stage of renal disease on QOL and pulmonary functions and this the first reason that necessitate introducing rehabilitation program for improving quality of life and pulmonary functions for those patients.

Results of study showed that there were significant reductions of QOL score; FEV1& FEV6 from one day pre-surgery to 3rd day postoperatively in control and pilates groups and this may be attributed to the effect of surgery on quality of life and pulmonary functions. The effect of surgery on respiratory system was attributed to (1) functional disruption of respiratory muscle movement caused by incisions. (2) The effect of postoperative pain in limiting respiratory motion. (3)Reflex inhibition of the phrenic nerve and other nerves that innervate respiratory muscles. As a consequences, in the postoperative period, normal respiratory muscle activity, particularly that of the diaphragm, is disrupted and the degree of disruption depend on several factors either related to the patient such as Age, general health & nutritional status or procedure related factors such as the type & duration of surgical approach, type of anesthesia, level

of incision and so on. The activity level of patient was affected due post-operative incisional pain. The effect of surgery on quality of life level and pulmonary functions that discussed previously was the second reason indicating rehabilitation program for improving quality of life and pulmonary functions for those patients.

In recent years, Pilates-based exercises have begun to be used by physiotherapists to support the rehabilitation programs for musculoskeletal conditions, sports injuries, and neurological disorders, focusing especially on the spine and its stabilization. However, there is still little scientific evidence regarding the benefits of Pilates-based exercises, especially for post renal surgical patients.

The aim of the study was to evaluate the efficacy of pilates exercises program in improving quality of life and pulmonary functions after Renal Transplantation.40 subjects were randomly divided into control group (C) and pilates group (P).Patients in control group received only medical care while pilates group received pilates exercises program started from the 3rd day postoperatively, once a day, 5 days / week for3 weeks postoperatively. Pulmonary functions and quality of Life score were evaluated one day before surgery, 3rd day & 3 weeks post operatively for all patients.

The results of the study showed that there were significant improvement in QOL score, FEV1& FEV6 in pilates group more than control group (p value <0.05) and this support the efficacy of pilates exercises program for improving quality of life and pulmonary functions.

Pilates [30] is a program that aims to improve strength, flexibility and posture, while coordinating the body and mind. It incorporates proper breathing techniques, muscle chains, muscle control, and an intense focus on the core muscles, and may implement special equipment to intensify results. Respiratory functioning is also enhanced by engaging in deep breathing techniques in Pilates. Pilates encourages complete inhalations and exhalations, stressing the importance of "squeezing" every single atom of air out of the lungs with the deepest of exhalations.

Previous studies [31-34] in the field of renal rehabilitation support the fact that exercise training in patients on hemodialysis (HD) is capable of ameliorating many of the morphological and functional disorders that accompany end-stage renal disease and improve physical fitness, behavioral characteristics, as well as their quality of life.

It was concluded that pilates exercises program is effective in improving quality of life and pulmonary functions in post renal transplantation patients.

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