EXERCISE-BASED RENAL REHABILITATION TRAINING FOR HEMODIALYSIS PATIENT - A PILOT STUDY.

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ABSTRACT
Chronic Renal Disease (CRD) is rapidly becoming a serious public health concern; its advancement can result in functional limitations and severe renal dysfunction, as well as a low quality of life. The current study clearly illustrates the effect of renal rehabilitation in hemodialysis patients, as well as a higher risk of functional impairment regardless of age, race, or comorbidities. The therapist should encourage patients with CRD, particularly the frail elderly, to increase their physical activity levels in order to establish that regular physical activity, such as aerobic or endurance activities, promoting the health. The research was carried out at Nandha College of Physiotherapy's outpatient department. This study used a basic randomized selection procedure with 32 subjects: 16 for the controlled group and 16 for the experimental group. Six participants dropped out of the research owing to a lack of enthusiasm. The FITTs (Frequency, Intensity, Time, Type) concept dictates a 10-week therapy period. A 6-minute walk test, WHO-QOL-BREF (World Health Organization Quality of Life Instrument) quality of life index, isometric quadriceps muscular strength and BMI, and urine albumin level were among the parameters measured. Patients were determined based on criteria for inclusion and exclusion. Hemodialysis patients demonstrated significantly worse exercise tolerance, cognitive functioning, and muscular atrophy than healthy individuals or those with less severe CRD. Hemodialysis patients can be evaluated by a physiotherapist based on their symptoms, such as decreased aerobic capacity, exercise capacity, and functional impairment. A physiotherapist can utilize a variety of therapeutic exercise strategies to help hemodialysis patients improve their exercise capacity and quality of life. The objective of this research is to provide an organized exercise regime for hemodialysis patients in attempt to optimize their exercise capability and overall quality of life.

Keywords: Renal rehabilitation, hemodialysis, exercise capacity, WHO-QOL-BREF.

INTRODUCTION
Chronic Renal Disease (CRD) is categorized as kidney deterioration or a steady glomerular filtration rate (GFR) of less than 60 mL/min/1.73 m2 (CRD). Chronic kidney disease (CKD) and end-stage renal disease (ESRD) are significant global health issues that are progressively becoming worse. End-stage renal disease (ESRD) individuals have a worse quality of life [1]. Hemodialysis is the sole steady-state option for individuals with ESRD, and it is used in around 80% of cases in India [2]. According to the Million Death Study, there were 1,36,000 kidney failure fatalities in India between 2015 and 2018, with almost 1,75,000 individuals on chronic dialysis, providing a frequency of 129 per million people. In India, over 1,30,000 people are on dialysis, and the number is growing at a rate of 232 per million people [3]. It is a process in which blood is purified using a dialysis machine and a specific filter known as an artificial kidney [6]. Hemodialysis prolongs a patient’s life, but it also coincides with a slew of limitations and a slew of physiological, emotional, social, and financial drawbacks [7].

Hemodialysis patients had decreased self-reported physical performance, as well as a greater risk of death and hospitalization. Patients with ESRD have low functional activity, and they acquire cardiovascular disease, infection, malignant neoplasm, and have a dismal prognosis after three years [8]. CRD is associated with a higher risk of functional impairment regardless of age, gender, comorbidities, or cardiovascular events [9]. Individuals with ESRD [10] and moderate-to-severe CRD (mean GFR of 25 ml/min/1.73 m²) [11], including those with milder CRD (mean GFR of 50 ml/min/1.73 m²), have been associated to functional impairments [9]. Anemia, protein-energy malnutrition, reduced muscular strength, metabolic irregularities resulting in reduced exercise tolerance, independence, capacity to accomplish ADL, and IADL are all plausible causes for these patients' limitations (Instrumental Activity of Daily Living). Because adult CRD patients experience ability
decline, rehabilitation strategies should be tailored to their age, functional limits, residual abilities, involvement, and co-morbidities. Clinicians must promote an active lifestyle with frequent physical exercise to CRD adult individuals with maintained ADL and IADL capacities to prevent functional deterioration. A multidisciplinary approach should be used with persons who have diminished abilities and more complicated limitations. [12]

Adults with CRD and after hemodialysis exhibited significantly reduced ADL (physical functioning) ability and capacity. [14]. Low levels of physical activity and poor physical functioning are substantially associated to mortality and poor clinical outcomes in these individuals, regardless of therapy approach [15]. The therapist should persuade CRD patients to enhance their physical activity and remind them that regular exercise is scientifically shown to promote health [16]. Exercise regimens are influenced by the frequency, intensity, and length of exercise training, as well as the type of activity and the individual's baseline level of fitness. Exercises that are aerobic, resistance, and flexibility should all be included with the training regimen. Aerobic activity should be gradually increased to a minimum of 30 minutes of moderate-intensity exercise 5 days a week. There is current evidence that Physical fitness, functional independence, cardiovascular dimensions (e.g., blood pressure and heart rate), health-related quality of life, and various nutritional indicators are all enhanced by regular exercise in individuals with CRD [14]. Physical exercise has the potential to improve all CRD and hemodialysis patients' aerobic and functional capacities, as well as their quality of life, regardless of disease stage [17]. Regular exercisers have a wide range of benefits, better physical functioning, higher sleep quality ratings, less physical activity restrictions, and are less influenced by pain or decreased hunger. In models adjusted for demographics, co-morbidities, and sociodemographic characteristics, those with CRD and hemodialysis who exercised frequently had a 27 percent decreased risk of death. Individuals who did not engage in any physical exercise were contrasted to all of those who did [18].

Patients on maintenance hemodialysis with ESRD exhibited significantly worse exercise tolerance, functional capacity, endurance, and muscle atrophy, as well as significantly higher fatigue, than healthy individuals or patients with less severe CRD who do not yet require replacement therapy [19].

Individual guidelines predicated on renal disease stage and/or therapeutic approach are currently unavailable; nonetheless, the various guidelines may be useful in prescribing exercise for CRD/ESRD patients. Those with the highest peak VO2 values (17.5ml/kg⁻¹ min⁻¹) may benefit the most from exercise training [20]. Patients should be tested before beginning exercise treatment to determine their fitness for exercise and to create tailored exercise prescriptions based on exercise tolerance and functional capacity assessments. The American College of Sports Medicine and the American Heart Association [21] released guidelines and contraindications for elderly people (65 years and older) that can be applied to hemodialysis patients. Peak VO2, cardiac function, quality of life, and sympathetic-adrenal activity have all been investigated to see whether they may be improved by exercise [22]. Lean body mass, quadriceps muscular area, knee extension, hip abduction, and flexion strength have all improved significantly [23].

Chronic Renal Disease (CRD) is a disease that worsens with time and has a significant impact on musculoskeletal health. Malnutrition, osteoporosis, and a loss of lean body mass are instances of co-morbidities. Secondary sarcopenia induced by CRD is linked to mobility impairments and a higher risk of collapse. Physical therapists are well-positioned among the health-care team to evaluate for secondary sarcopenia in persons with CRD and treat musculoskeletal comorbidity problems that might compromise functional performance. Given the consequences of both low muscle mass and low bone mineral density, sufficient and prompt physical therapy is essential for fall risk assessment and management in order to prevent bone fracture susceptibility. Despite the fact that strength training has received less investigation than aerobic exercise for the management of secondary CRD issues, data suggests that this patient population benefits from strength training. However, a health care professional's formal exercise prescription, as well as the formal execution of an exercise programme, may need to be more thoroughly incorporated into the routine plan of treatment for patients with CRD [24].

The benefits of exercise treatment on glomerulonephritis patients were assessed using four outcomes: survival rate, QOL (Quality of Life), deterioration in renal function, and elevation in urine protein [25].

Aim and Need for the Study
Hemodialysis patients have a high risk of morbidity due to their sedentary lifestyles and cardiovascular problems. We Can Reduce the Risk of Cardiovascular Problems and Improve Exercise Capacity and Quality of Life in Patients Who received hemodialysis by Introducing an Exercise-Based Renal Rehabilitation Program in the Initial Phase. 2014 (Anna P. Rossi). The goal of this study is seeing how an exercise-based renal rehabilitation programme impacts exercise capacity and Quality of Life (QOL) in hemodialysis patients.

Methodology
Nandha College of Physiotherapy's op department hosted the pilot trial. This study used a basic randomized sampling procedure with 32 subjects: 16 for the control group and 16 for the experimental group. Six volunteers from each group were dropped from the research owing to a lack of interest. The FITT's concept dictates a 10-week therapy period. A 6-minute walk test, WHO-QOL-BREF (World Health Organization Quality of Life Instrument) quality of life index, isometric quadriceps
Muscular strength and BMI, and urine albumin level were among the parameters measured. Patients were chosen based on criteria for inclusion and exclusion. Age 20-45 years, both men and females, participation in hospital hemodialysis for the previous 3 months, Glomerular Filtration Rate (GFR) less than 15, urine albumin >3 mg/mmol/L and < 29 mg/mmol/L [moderate albumin-urea], and level of participation are among the inclusion criteria. Patient was ruled out due to a recent myocardial infarction, uncontrolled arrhythmias, left ventricular dysfunction, uncontrolled hypertension, severe decompensate diabetes, unstable angina, neoplasms, pregnancy, chronic lung disease, cerebral vascular diseases, lower-extremity amputation, and pre-existing cardio-respiratory, neuromuscular deficits.

INTERVENTION

Structures exercise program based on the exercise prescription FITTs principle. Frequency of exercise program: One hour per day, 2 days a week, 10 weeks of exercise program, and 2 weeks of follow-up. Mild to moderate level intensity of exercises including aerobic, flexibility exercises, progressive resisted exercises.

Individual guidelines for renal disease patients by stage and/or therapeutic approach do not yet exist; nonetheless, the following recommendations for CKD/ESRD exercise prescription may be beneficial. Exercise training may be particularly beneficial to those with the highest peak VO2 values (17.5 mkg \(^{-1}\) min\(^{-1}\)) \(^{51}\). Before commencing exercise rehabilitation, patients should be evaluated to determine their exercise capacity and to construct tailored exercise prescriptions employing exercise tolerance and functional capacity tests. For elderly people (65 years and older), the American College of Sports Medicine and the American Heart Association have issued guidelines and contraindications that can be applied to hemodialysis patients \(^{53}\). Exercise enhances peak VO2, cardiac function, quality of life, and sympathetic-adrenal activity. Lean body mass, quadriceps muscular area, knee extension, hip abduction, and flexion strength seem to have become improved. \(^{54}\).

Outcome Measures

VO2 max, blood pressure, and aerobic capacity, risk of mortality, physical functioning, exercise capacity, and quality of life are all concerns that some researcher conducted. A 6-minute walk test was used by certain researchers to measure the exercise ability of Hemodialysis patients. The test's habilitation and validity were strange. It is a typical physical examination among dialysis patients. It is a self-paced walking capacity test that assesses functional ability in daily physical activities that are often conducted at a submaximal level of effort. Keep a record of the Borg dyspnea and fatigue levels following the walk.

At 6 minutes, keep records of how many laps you've completed. Calculate how much further individuals walked in 6 minutes. It is a highly valuable tool for determining an individual's exercise capability. It aids in the evaluation of pulmonary, cardiac, muscular strength, orthopedic, and cognitive function. To evaluate quality of life, the health-related quality of life (HRQOL) questionnaire is generally implemented. HRQOL in hemodialysis patients can be evaluated using the condition-specific HRQOL. Individuals' perceptions of their roles in life in relation to the culture and value systems in which they live, as well as their goals, expectations, standards, and concerns” is defined as "individuals' perceptions of their positions in life in part related to the culture and value systems in which they live, as well as their goals, expectations, standards, and concerns.”

The WHO QOL-BREF questionnaire was used to determine dialysis patients' quality of life. Variables from the physical, psychological, socioeconomic, and environmental realms are all addressed. The WHO-QOL group developed a comprehensive health-related questionnaire for ESRD patients. The score was determined once it was presented to the research participants. The unprocessed data was turned into processed data. A standardized dynamometer was used to evaluate the isometric quadriceps muscle strength. Dialysis patients are less active and have a reduced exercise ability than the general population. The patients are asked to conduct isometric muscular contractions using a portable dynamometer that is placed under their knee. We were able to properly and effectively evaluate muscular strength by using a portable dynamometer test. Muscle strength was required to carry out day-to-day tasks. Body mass index (BMI) is a measurement derived from a person's weight and height and represented in kilogram per square meter (kg/m\(^2\)).

The BMI is a key factor in determining if a person is underweighted, normal weight, or overweight. For chronic hemodialysis patients under 60 years of age, the BMI associated with steady hemodialysis has a baseline mortality rate of roughly 20. In contrast, the effects of BMI on chronic hemodialysis patients are undetermined.

Data Analyzation:

We have taken the pre and post-test values using the WHO QOL-BREF questionnaire of both the control and experimental group. And we analyze the data with the help of a one-sample t-test.

| Table 1: Rehabilitation protocol |
|-----------------------------|-----------------------------|-----------------------------|
| Rehabilitation Phase | Controlled Group | Experimental Group |
| Phase I | Chest Physiotherapy | Chest physiotherapy |
| | Breathing Exercise | Breathing exercise |
| | Incentive Spirometer | Incentive spirometer |

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Results

After 12 weeks of renal rehabilitation, dialysis individual's exercise capacity and quality of life improve significantly. There is a significant difference in isometric quadriceps muscle strength and body mass index after 12 weeks of renal rehabilitation. Renal rehabilitation based on exercise reduced fatigue, weakness, increased quality of life, and reduced morbidity.

Discussion

Protein-energy wasting (PEW), commonly known as frailty, is a condition in which an individual experiences both malnutrition and wasting at the same time. As a result, nutritional therapy plays a critical role in the management of PEW and frailty as a malnutrition treatment. For patients who are malnourished or wasting away, nutritional therapy targeted at maintaining protein
and energy intake is critical. Dietary Recommendations for Chronic Dialysis Patients, issued by the Japanese Society for Dialysis Therapy in 2014, suggests an energy intake of 30–35 kcal/kg and a protein intake of 0.9–1.2 g/kg [25].

However, when compared to nutritional therapy alone, a combination of dietary and exercise interventions drastically enhanced physical performance and quality of life in individuals with PEW [26]. As a consequence, nutritional and exercise treatment complement each another. Hemodialysis Guidelines regarding Maintenance: For small-molecule medications, the Japanese Society of Dialysis Therapy recommends a spKt/V of ≥ 1.4 and a 2-microglobulin level of <30 mg/L for hemodialysis prescriptions. Furthermore, comprehensive anaemia care is necessary [27].

While these are observational findings, there has been a report that an increase in Hb caused by fluctuations in the type of Erythropoiesis-stimulating agents (ESA) led to an improvement in the vitality score of quality of life [28], and a meta-analysis found that an increase in Hb exacerbated by Erythropoiesis-stimulating agents from Hb < 10 g/dL to Hb ≥ 10 g/dL was associated with using an When it comes to exercising, both of these improvements in vibrancy and malaise might be advantageous.

According to the 2015 Japanese Society for Dialysis Therapy: In hemodialysis, a baseline Hb level ought to be between ≥ 10 and < 12 g/dL, according to the Renal Anemia in Chronic Kidney Disease Guidelines. Because dialysis patients tend to have a sedentary lifestyle on the day of dialysis, presumably due to inactivity during the dialysis process and the post-dialysis fatigue syndrome [31], physical activity levels in dialysis patients have been proven to be lower. As a result, geriatric dialysis patients' physical function is thought to be roughly half that of the general population [32].

Furthermore, an observational research [33] demonstrated a relationship between exercise and a positive prognosis. These findings imply that exercising and maintaining a constant level of physical activity are effective opportunities to strengthen or maintain survival, physical functioning, ADL, and quality of life. Exercise & Sports Science Australia [34] released a policy statement on exercise treatment for CKD patients, outlining specific exercise therapy recommendations for individuals with end-stage renal disease on both dialysis and non-dialysis days. The American College of Sports Medicine has produced exercise evaluation and prescription recommendations [35], the most recent incarnation of which includes particular methods and disclaimers for dialysis patients. We investigated the efficacy of exercise treatment in dialysis patients as a consequence [30]. Clinical trials with a ≥ 6-month intervention phase showed greater improvements in exercise tolerance (VO2) than studies with a < 6-month intervention length, according to a recent meta-analysis of exercise rehabilitation [36]. Furthermore, the same meta-analysis demonstrated that clinical studies that integrated aerobic exercise rehabilitation and strength training enhanced exercise tolerance more than studies that was just using aerobic exercise treatment.

Despite a greater rate of dropouts, exercise rehabilitation under supervision on non-dialysis days increased exercise tolerance more than dialysis days [37]. The association between such a distinct method and exercise treatment efficacy must be examined while implementing exercise therapy. It will be crucial in the future to validate the most effective technique for exercise treatment for peritoneal dialysis patients. In any case, the ultimate goal of dialysis therapy is social as well as renal rehabilitation.

Exercise, which is a crucial component of renal rehabilitation, enhanced physical capabilities and quality of life significantly. In this instance, renal rehabilitation is critical to achieving the dialysis therapy's objective. Exercise training can be done both outside of dialysis, as outpatients or at home, and during dialysis, as interdialytic exercise. To improve strength and maintain physical function, advanced equipment such as a leg press and free weights have been used. Elastic bands, on the other hand, are a simple and economical alternative for resistance training during dialysis treatments [40]. Although there are still uncertainties about the most effective physical regimen for achieving a goal, no changes in physical function or vascular markers have been documented when comparing intra-dialytic vs. home-based aerobic exercise training in Hemodialysis patients [41].

Physical rehabilitation is more likely to be sought by the most fragile and incapacitated patients as part of their therapeutic therapy. Regardless of age, gender, or previous functional status, beginning dialysis is associated with structural impairment, but the impact is higher in the elderly. Dialysis patients had a 50% reduced functional capacity than gender- and age-matched healthy individuals, as according Sticky et al [42]. After a year of hemodialysis, only 13% of individuals continue to operate normally [38]. Dialysis participants experienced a quicker rate of functional decline, which leads to mobility problems, falls, fractures, and functional restrictions, exposing hemodialysis patients to higher healthcare expenditure and length of hospital stay. According to report from the United States Statistics System, 25% of new dialysis patients are above the age of 75, and elderly dialysis patients are the fastest-growing category [41],[43]. Diabetes, coronary artery disease, heart failure, multidimensional arthritis, pain, neuropathy, psychological conditions, and cognitive impairments are all prevalent comorbidities in geriatric hemodialysis patients, resulting in functional limitations and a decrease in overall quality of life. A patient-centered intervention [39], as well as a step-by-step strategy to determining the outcome to improve [45], has been recommended. Providers must be prepared to apply an integrated, tailored, patient-centered strategy in elderly patients with advanced CRD.

To ESRD older individuals with multiform impairment who require medical treatment, a comprehensive multidimensional strategy and goal-oriented management should be administered. Specialized geriatric rehabilitation units with on-site dialysis have been proposed in this way, where older dialysis patients with new-onset functional decline can receive
integrated multidisciplinary care from rehabilitation, geriatric medicine, and nephrology experts, as well as reciprocal continued medical education among staff [46],[47].

For such individuals, discussions regarding treatment goals and advance care planning should be routine. Patients and caregivers should stop triggering unrealistic "rehabilitation goals" like recovering independence that the patient hasn't had in years or reversing an incurable condition. [48].

Hemodialysis patients over the age of 75 might anticipate a life expectancy of 2.6 to 3.2 weeks after taking dialysis [49]. Because these patients are more likely to die prematurely, it's vital to determine whether they and their caregivers would prefer that more effort be invested into obtaining quantity of life over quality of life [50].

Conclusion
Exercise-based rehabilitation is an effective and efficient strategy to alleviate the burden of physical incapacity while encouraging activity and engagement. Patients on hemodialysis should get exercise training based on their clinical situation and cognitive limitations.

Exercise-based renal rehabilitation training enhances exercise capacity and quality of life in hemodialysis patients, according to this study. An structured exercise regime can assist forestall muscle weakness, improve physical function, and reduce the likelihood of mortality from cardiovascular complications from the commencement of hemodialysis.

In ESRD, habitual adjustments, in addition to exercise and nutrition, assist in reducing the frequency of dialysis. However, to maximize the exercise-based rehabilitation programmed for hemodialysis patients, large-scale randomized controlled studies are necessary. Every hemodialysis patient who does not have a medical contraindication is urged to participate in an aerobic exercise program.

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