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Katarzyna Chojak-Fijałka, Urszula Chrabota

Institute of Applied Sciences, University of Physical Education in Kraków, Poland

Regular physical activity — an important part of treatment in peritoneal dialysis patients

ABSTRACT

The population of peritoneal dialysis (PD) patients is characterized by a low level of physical activity. A significant decrease in fitness level compared to their peers leads to impaired functioning in everyday life and is associated with worse survival. This study aimed to characterize the physical activity of PD patients, develop recommendations for physical activity considering catheter safety and filling of the peritoneal cavity, as well as to indicate methods of PD patient evaluation and benefits of regular physical activity. A low level of physical activity is a result of chronic kidney disease, comorbidities, and a sedentary lifestyle. According to current guidelines, physical exercise is indicated in this group of patients. In physiotherapy planning, the specific needs of peritoneal dialysis patients should be taken into account, as well as comorbidities and patients' preferences. Regular physical activity brings real benefits. Unfortunately, in Poland, peritoneal dialysis patients are not routinely enrolled in rehabilitation programs.

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Key words: peritoneal dialysis, physical activity, physical exercise, physical functioning

INTRODUCTION

The population of patients with chronic kidney disease (CKD) in Poland in 2021 was 144 patients per million inhabitants. More than half of the patients (55%) were over 65, and 21.3% were over 75. The most commonly used method of renal replacement therapy is dialysis while peritoneal dialysis (PD) patients account for 4% of this group. Younger, more physically fit, and independent patients are usually qualified for this type of therapy. Only 25% of patients starting PD are aged ≥ 65 [1].

CKD leads to reduced fitness and physical performance. Low fitness level is unfavorable in terms of both independent functioning and life expectancy. The decline in performance is very closely correlated with survival in this group [2, 3]. In medical databases, there are more and more publications on the needs of this population in terms of improving physical functioning. The inspiration for our study was the publication of the guidelines developed by experts from the *International Society for Peritoneal Dialysis* and *Global Renal Exercise Network* titled "Physical Activity and Exercise in Patients on Peritoneal Dialysis: ISPD/GREX Recommendations" [4]. Based on the literature review and clinical experience, the expert team has developed a set of guidelines for clinical practice.

This study aimed to characterize the physical activity of PD patients, develop recommendations for physical activity considering catheter safety and filling of the peritoneal cavity, indicate methods of PD patient evaluation, and identify benefits of regular physical activity.

PHYSICAL ACTIVITY

Physical activity is certainly part of life. Among new patients with end-stage renal failure, there is a decrease resulting from progression of the disease and occurrence of comorbidities. Physical exercise is a recognized method of improving physical performance and quality of life. However, most peritoneal dialysis patients (56%) exercise less than once a week, 75% report severe limitations in performing vigorous exercises and 42% in taking moderate exercises [5].

Address for correspondence:
Katarzyna Chojak-Fijałka,
Institute of Applied Sciences,
University of Physical Education
in Kraków, Poland,
al. Jana Pawła II 78,
31–571 Kraków, Polska,
e-mail:
katarzyna.chojak@awf.krakow.pl

FITNESS

PD patients show a significantly lower level of fitness compared to the general population. The most precise method of its evaluation is the cardiopulmonary exercise test (spiroergometry), during which the maximal oxygen uptake (VO_{2max}) is measured. Assessment of physical performance based on the results of the exercise test measuring maximum values is mainly used in scientific research. PD patients achieve significantly lower mean maximal oxygen uptake (VO_{2max}), i.e., 14.6 mL/kg/min compared to the control group (33.6 mL/kg/min) [6]. In clinical practice, sub-maximal tests are used to assess peak oxygen uptake. PD patients reach only 63% of the peak oxygen uptake (VO_{2peak}) [7]. The results of a 6-minute walk test (6MWT) are also an indirect confirmation of reduced fitness, which correlate with the risk of hospitalization in the group of older PD patients [8]. In clinical practice, accelerometers are also used to assess the level of physical activity. Those devices simply measure the number of steps taken daily, which makes it possible to assess the level of physical activity. Measurements taken in PD patients confirm a lower level of physical activity in this group. PD patients take an average of 4839 ± 3313 steps a day, and most of them (63%) can be referred to as inactive (< 5000 steps a day) [9]. Only 29% of PD patients reach the level of fitness of healthy people [10]. The reduced level of physical activity of PD patients is also reflected by the results of the self-reported Human Activity Profile. In all age and sex categories, the results were below the fifth percentile for healthy people. Similar conclusions were reached based on the World Health Organization's (WHO) Global Physical Activity Questionnaire (GPAQ) analysis — insufficient level of physical activity was found in 86% of PD patients [11].

CAUSES OF REDUCED PHYSICAL ACTIVITY

There are many reasons for reduced physical activity in PD patients. Most of them are associated with aspects of CKD itself, such as uremic toxins, electrolyte imbalance, myopathy, or sarcopenia. Most PD patients (84.5%) are characterized by significantly reduced muscle strength and do not fall within normal limits for age and sex [12]. Undoubtedly, other factors include co-existing circulatory and metabolic disorders or depression. All of those can cause a decrease in physical fitness, which affects performance and willingness to undertake physical activity in patients. When comparing the physical activity level of PD patients with non-dialyzed CKD patients, no difference was observed, suggesting that peritoneal dialysis alone does not cause a decrease in fitness level [12]. The level of physical activity correlates with malnutrition-inflammation-atherosclerosis syndrome [10] or malnutrition alone [12]. Decreased albumin levels correlated significantly with a higher level of fatigue and lower readiness to engage in various activities [13]. The physical activity level in PD patients is related to their age and nutritional status. For PD patients, it has been shown that a better nutritional status has a positive effect on the physical activity level [9]. A lower level of physical activity is also affected by comorbidities, hemoglobin level, body composition, and education level [14]. Willingness to exercise, which affects the physical activity level, is influenced by comorbidities, general fatigue, muscle fatigue, shortness of breath [15], weakness, pain, lack of time, and fear of adverse events during exercise, including fear of the consequences of falling [16]. Fatigue is the main factor limiting patients' physical activity [17]. Women and elderly people are much more likely to experience fatigue and are less active than men and younger people. A significant difference was observed between the mean fatigue score and physical activity depending on the type of renal replacement therapy, with PD patients reporting the greatest fatigue and lower physical activity. CKD patients, whether they are in the pre-dialysis stage or receiving hemodialysis or peritoneal dialysis, experience high levels of fatigue and are less able to perform daily activities [13]. A small percentage of patients raise concerns about physical activity due to their catheter, the presence of dialysis fluid within the peritoneal cavity, possibility of hernia formation and leaks. Patients are not educated on their ability to exercise and are not always aware of its benefits. In their opinion, there are no medical recommendations for physical activity [15, 18]. This undoubtedly translates into weak motivation to undertake additional regular physical activity and a low level of activity in this population [11, 16, 17, 19].

RECOMMENDATIONS FOR PHYSICAL ACTIVITY

According to the WHO guidelines, people with low physical activity should gradually strive to reach 150 to 300 minutes of physical activity per week. It is recommended to have moderate-intensity endurance training

(e.g. walking, swimming, dancing), or 75 to 150 minutes of vigorous endurance training (e.g. jogging, competitive sports). It is also recommended to combine endurance training with strength exercises of moderate and medium intensity. Those recommendations were confirmed by the International Society for Peritoneal Dialysis (ISPD) guidelines for PD patients [4]. All sorts of physical activity and reducing a sedentary lifestyle can improve patients' performance. The safety of both endurance and strength training has been established. The guidelines recommend that exercise intensity should be adjusted to the patient's condition and well-being, while gradually increasing the intensity. In the elderly group, balance and strength exercises should be introduced to reduce the risk of falls.

PHYSIOTHERAPY IN PERITONEAL DIALYSIS

The choice of the type of activity or form of training should take into account the patient's current condition, needs, lifestyle, and the type of peritoneal dialysis [continuous ambulatory peritoneal dialysis (CAPD), automatic peritoneai dialysis (APD), continuous cycling peritoneal dialysis (CCPD), nocturnal peritoneal dialysis (NPD)]. The population of dialysis patients is heterogeneous in terms of physical performance. It includes more physically fit younger patients, who are often professionally active, as well as older patients with frailty syndrome, who require help in everyday activities. Young people without co-existing cardiovascular disorders do not require any specific rehabilitation but rather instruction on how to safely continue the physical activity from before initiation of renal replacement therapy or how to incorporate it into their lives due to the cardioprotective nature of the physical exercise. Renal replacement therapy always takes precedence over motor rehabilitation. This means that physical exercises are introduced in patients in stable condition.

PHYSICAL ACTIVITY AND PERITONEAL CATHETER SAFETY

Regardless of the technique used for surgical catheter implantation, walking is considered safe and should be introduced as soon as possible. However, until the tissues are healed, any activities accompanied by an increase in intra-abdominal pressure (IAP), such as weight lifting of $>$ 5–10 kg, wood cutting, snow clearing, vacuuming, or squats are allowed after at least 2 to 3 weeks since laparoscopic catheter implantation, and after 4 to 6 weeks from open surgery [4].

Patients should wear clean, breathable clothing to reduce sweating and possible soiling around the catheter during physical activity. At the same time, it is crucial to always secure the outer part of the catheter with a special belt that stabilizes it and prevents injury around the catheter insertion site. During more intense physical exercises, it is recommended to additionally protect the catheter with a stabilizing dressing. Non-occlusive dressing (e.g. from gauze) reduces micro-injuries of the skin around the catheter during physical activity. However, if dirt or water gets in the area around the catheter insertion site during physical exercises, the dressing should be replaced by a fresh one. Obese PD patients are at a higher risk of complications at the catheter site due to sweating [20].

During swimming and doing water sports, there is a risk of a possible infection. For this reason, bathing and water sports are not recommended in the period of 4 to 6 weeks after catheter implantation. Later, it is suggested to use marine bathing spots or well-maintained pools to reduce exposure to pathogens in water. Of course, the catheter entry site should be protected with a waterproof dressing or with an ostomy bag. It is recommended to replace the dressing above the catheter entry site after swimming or water sports [4].

Contact sports, where there is a risk of physical injury or repeated friction around the catheter site, are not recommended.

PRESENCE OF DIALYSIS FLUID IN THE PERITONEAL CAVITY

Many patients consider dialysis fluid to be a barrier to physical activity [16]. However, the results of the exercise test on the treadmill with progressive load in terms of maximum oxygen uptake or maximum heart rate are the same with an empty and filled peritoneal cavity [6]. Activities that do not significantly increase the IAP, i.e. walking or running, do not require drainage of fluid from the peritoneal cavity unless the filled peritoneal cavity causes discomfort. However, activities that increase the IAP, i.e. weight lifting, snow clearing, or jumping require drainage of the fluid from the peritoneal cavity before exercises. Sports that require frequent bending, crouching, or lifting should be performed without fluid in the peritoneal cavity. When performing such movements, the following risk factors should be taken into ac-

count: age, physical fitness, coexisting diseases, duration of dialysis therapy, and previous injuries. If a pink or red color of the dialysis fluid is observed, it suggests intraperitoneal bleeding, and it is recommended that sports should be discontinued. Sports activities can be resumed after the issue resolves and after a consultation with a nephrologist [4].

Exercises engaging the muscles of the trunk are recommended for PD patients. Stronger core muscles can better stabilize the lumbar region and also prevent low back pain. The presence of dialysis fluid in the peritoneal cavity increases the IAP. However, stronger transversus abdominis muscles can potentially reduce the risk of hernias [4].

PHYSIOTHERAPY EVALUATION

The routine assessment of physical function and physical activity should be an integral part of clinical evaluation of the patient [21]. PD patient's physiotherapy evaluation for regular physical activity and regular exercise may include

- physical examination: lean body mass, height and circumference measurements, calculation of the following indices: BMI (Body Mass Index), WHR (Waist to Hip Ratio), and WHtR (Waist to Height Ratio) [22], as well as body composition assessment [23];
- assessment of the cardiovascular system at rest (heart rate and blood pressure, echocardiography, electrocardiogram) and during exercise (stress electrocardiogram). Those studies are necessary to exclude contraindications for vigorous exercise, determine the optimal intensity of exercise, and later evaluate the effectiveness of training programs. During the qualification for training programs, it is recommended to assess the physical capacity with the exercise test on the treadmill or ergometer, as well as indirectly using the 6-minute walk test. To monitor the progress of the training, a 6-minute walk test should be performed regularly while the exercise test should be considered if there are any worrying symptoms or when requested by a physician;
- assessment of muscle strength based on the following parameters: measurement of the hand grip strength (HGS) or by functional tests, i.e. Sit-to-Stand Test (STST) in 30- or 60-second version for evaluation of the lower limb strength, the Arm Curl Test (ACT) indirectly assessing the strength of the upper limbs, the Lovett test to assess the strength of the abdominal muscles, or 1, 3 or 5 repetition maximum tests (1 RM, 3 RM, 5 RM);
- assessment of muscle endurance by a maximum number of repetitions of 60% 1 RM or 80% 5 RM for a selected muscle group;
- assessment of physical activity, using objective tools such as accelerometers or pedometers, or based on the International Physical Activity Questionnaire (IPAQ);
- assessment of simple and complex daily activities using the Katz index or Lawton scale;
- assessment of health-related quality of life using the KDQol-SF questionnaire (Kidney Disease Quality of Life — Short Form).

THE BENEFITS OF PHYSICAL ACTIVITY FOR PD PATIENTS

A lack of physical activity can lead to a decrease in physical fitness, weakened muscle strength and endurance, increased body mass, increased risk of developing cardiovascular diseases or diabetes, but also deterioration of quality of life, or increased risk of depression. Motivating patients to participate in training programs can result in their better functioning and well-being. The most important benefit of regular physical activity is improved physical fitness associated with adaptive changes in the circulatory system [24]. This is therapeutically significant, as improved performance in CKD patients reduces the risk of death [25]. The improved physical performance, expressed indirectly by an increase of 20 m in the 6MWT, was associated with a reduction in the risk of death, cardiovascular incidents, and hospitalizations [26]. There is also a link between fitness level and health-related quality of life [24]. Improved aerobic capacity has been shown to significantly affect the quality of life assessed by KDQOL-SF [27].

Another aspect of regular physical activity is weight control and the prevention of insulin resistance. Obesity is an important issue in peritoneal dialysis patients due to increased absorption of glucose from the dialysis fluid [28]. Within the first year of dialysis, most patients have seen an increase in body weight resulting from visceral and subcutaneous fat growth [29]. The consequence of this may also be the development of insulin resistance. Physical activity can have a beneficial effect on this condition and can increase tissue sensi-

tivity to insulin, reducing the risk of metabolic disorders [30]. Based on the ISPD guidelines, it can be concluded that physical activity in obese PD patients is safe and recommended as a method of weight control, and its effectiveness can be increased through a properly balanced diet [4].

Mental health is an equally important area where regular physical activity can bring benefits. Physical exercise can improve the mental health of PD patients both in terms of prevention of mood disorders and as supportive therapy [24, 31]. The ISPD recommends moderate-intensity exercises, performed 3 to 5 times a week over 20 to 30 minutes to maintain and improve well-being [4].

The reduced physical fitness of PD patients is associated with higher mortality, a higher number of falls and hospitalizations, reduced cognitive function, loss of independence in everyday activities, and deterioration in quality of life. Physical activity can have a positive effect on the patient's condition and reduce the risk of disability and falls [32]. Physical activity is recommended despite the fatigue associated with PD. It is suggested that regular physical activity can reduce the overall feeling of fatigue and improve well-being [20].

The benefits of regular physical activity listed above should be drawn to the attention of patients. From their perspective, the benefits of physical activity are the following: weight control, improved quality of life, mood, and greater independence in everyday activities. It is worth mentioning that those results were obtained in PD patients with a low level of physical activity [11].

CONCLUSIONS

Currently, nephrology patients are excluded from physiotherapy care by the national payer. They use rehabilitation programs indicated by co-existing diseases (cardiovascular, pulmonary, orthopedic, surgical, etc.). Therefore, these patients, medical staff, but also people in charge of the national healthcare system should be educated about the benefits of regular physical activity in PD patients so that in the near future the motor rehabilitation of PD patients will be part of standard care in Poland.

CONFLICT OF INTEREST

None to declared.

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