Rehabilitation of patients after kidney transplantation

Patients undergoing kidney allotransplants need help in recovery. Improvement of health status after the intervention depends in large measure on cooperation of the therapeutic team. For many physiotherapists, rehabilitation after transplantation becomes a problem with such patients, and there is scant data in the literature about methods for encouraging patients to exercise.

The aim of this study was to analyze the accessible literature relating to physical activity and rehabilitation of patients dialyzed after kidney transplant. Also the performance of proceeding in improving the patients after kidney transplant and the continuation of the farther physical activity.

The review was based on articles relating to the rehabilitation of patients with kidney disease.

Based on the literature we can state that kidney transplant patients may sit upright as soon as the 3rd day after transplantation if there are no medical contraindications. Regular supervised physical activity allows initiating training with the submaximal workload not greater than 80% Vo2max.

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Rehabilitacja pacjentów po przeszczepie nerki

Przeszczepy allogeniczne nerek w oparciu o dotychczasową wiedzę stanowią procedurę niestwarzającą większych problemów wśród chirurgów. Poprawa stanu zdrowia po zabiegu zależy w dużej mierze od współpracy wielu członków zespołu terapeutycznego. Rehabilitacja po transplantacji staje się dla wielu fizjoterapeutów problemem w postępowaniu z takim pacjentem a zbyt mała ilość literatury na ten temat nie wyjaśnia, jakimi metodami można się posługiwać, żeby bezpiecznie doprowadzić chorego do stanu zdrowia.

Celem pracy była próba analizy dostępnej literatury poruszającej tematykę aktywności fizycznej i rehabilitacji u chorych dializowanych i po przeszczepie nerki.

Opracowanie przygotowano w oparciu o zbiór artykułów poruszających tematykę rehabilitacji osób z chorobami nerek.

W oparciu o dostępne pismienictwo można stwierdzić, że brak przeciwwskazań medycznych pozwala na pionizację chorego w trzeciej dobie po zabiegu. Regularna nadzorowana aktywność fizyczna umożliwia wprowadzanie ćwiczeń z obciążeniem submaksymalnym nie większym niż 80 %Vo2max.

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Introduction

Many epidemiological and experimental studies have investigated the beneficial effects of physical exercise, which is one of the best ways to prevent diseases of the cardiovascular system in primary and secondary prevention. The increase of physical activity in the population has a number of beneficial health implications. Regular physical exercise improves blood circulation and lowers blood pressure and heart rate at rest and during exercise. It acts as a stimulant on the endothelium of blood vessels and stimulates the growth of muscle and bone mass. It affects metabolic processes of oxidation of glucose and fatty acids, and lowers cholesterol. Physical exercise regulates the secretion of systemic hormones through adipose tissue. It reduces oxidative stress and influences the secretion of cytokines. An important aspect of increased physical activity is improved quality of life. Low-level physical activity, smoking, hypertension, diabetes, and hypercholesterolemia are of the 5 main risk factors for cardiovascular disease of life. Low-level physical activity, smoking, hypertension, diabetes, and hypercholesterolemia are of the 5 main risk factors for diseases of the cardiovascular system. As demonstrated by van Wyk, at least 1 of the above risk factors [1] is present among 75% of the people diagnosed with heart disease (women and men).

The definition of chronic kidney disease (CKD) was introduced by the American National Kidney Foundation (NKF) [2] in 2002. This term defines kidney damage confirmed by biopsy test. The diagnosis is performed on the basis of the exponents of kidney damage present for at least 3 months, irrespective of the glomerular filtration rate (GFR), or on the basis of GFR lower than 60 ml/min/1.73 m², lasting for at least 3 months. The exponents of kidney damage include: increased excretion of albumin in the urine, proteinuria, and other abnormalities in the urine sediment examination or abnormalities in the imaging examinations of kidneys.

There are 5 stages of CKD based on GFR. The 5th stage, referred to as renal failure (NN), is the most advanced and requires renal replacement therapy. Before patients are qualified for transplantation, they must undergo dialysis, which greatly affects quality of life and takes much time. In turn, this situation leads to decreased phy-
physical activity. The ill patients avoid not only regular exercises; they are also reluctant to perform daily activities [3-9,10] due to complications occurring in patients with chronic kidney disease and renal replacement therapy, which affect the ill patient's ability to engage in physical exercise. Protein-energy malnutrition causes increased degradation and reduced protein synthesis, as well as impaired immune defense mechanisms, leading to increased susceptibility to acute and chronic infections [11,12]. In addition, uremic atrophy, skeletal muscle dysfunction, and anemia, as well as increased oxidative stress and neurohormonal disorders, should be mentioned. This observation is supported by experimental studies conducted by Stack et al [3], showed that 56% of patients starting dialysis therapy engage in physical exercise only once per week or less.

A few years ago, the problem of insufficient physical activity of patients with chronic kidney disease led to the establishment of the Working Group on Renal Rehabilitation and Exercise Physiology, affiliated with the European Renal Association (ERA - EDTA) [13]. The Group is engaged in promoting physical activity, especially among dialysed patients.

The aim of the present study was to analyze the available literature relating to physical activity and rehabilitation patients who were dialyzed and after kidney transplant. Also the performance of improving in the patients after kidney transplant and the continuation of the farther physical activity.

The adverse influences of insufficient physical activity are concomitant diseases that can lead to death and not, as one might guess, to the underlying disease. Reference materials report that up to 57% of deaths of the patients dialysed in Poland in 2004 was due to CVD. The presence of these diseases in patients who died due to renal failure increased by 10% in the period from 1999 to 2004 [14].

CVD risk factors such as diabetes and hypertension are classified as traditional and non-traditional factors specific for kidney failure and various forms of renal replacement therapy [15].

**Influence of the lack of the physical activity**

A well-functioning neuromuscular and skeletal bone system is essential for physical activity. Many functional and structural disturbances occur in these systems in the fifth stage of the disease. Serratrice et al [16] described a patient with chronic renal failure, in whom progressive muscle weakness was observed, probably due to uremia. They used the phrase 'uremic myopathy' for the first time.

Another cited element playing an important role in insufficient physical activity is active vitamin D deficiency. This condition is noticeable from the second stage of chronic kidney disease. In addition, these ill patients have reduced glucose utilization, which is needed for high-energy tissue regeneration, caused by, among others, aerobic glycogen (white fast fibers). As a result of these changes, glycogen deposits form and a tendency to metabolic acidosis is noticed during physical exercise as a consequence of increased production of lactic acid [19].

Another important domain, although it is not of primary concern, is damage to the skeletal structure. This issue is rarely mentioned because such changes do not occur in every patient. Histological imaging shows atrophy, mainly among type II fibers (white fast fibers) [20,21].

Patients with chronic renal failure are often malnourished. This condition is present in the early stages of the disease, and deepens with the progression of renal failure. Left ventricular hypertrophy occurs in 74% of patients starting dialysis treatment. According to the results of epidemiological studies, it is an important risk factor for hospitalization and mortality [20,21]. Hypertension and anemia cause cardiac hypertrophy.

The kidneys are very efficient organs and most people can live a normal life while retaining only 15% of renal functions. However, in the event of a total kidney failure, they are not able to excrete toxic products present in the urine and the concentration of these substances in blood increases.

Chronic renal failure is progressive, and renal function decreases irreversibly. This condition may occur as a result of recurrent infections, diabetes, hypertension, or congenital anomalies of the urinary tract. In the final stage of the disease, the kidneys completely cease to function and excrete urine.

People with kidney diseases additionally suffer from weakness, easy fatigability, loss of appetite, swelling of ankles and lower legs, difficulty in breathing, shortness of breath, and many other symptoms resulting from the ongoing complications of the disease in the later period.

Treatments ranging from pharmacotherapy to dialysis are merely substitutes leading to kidney transplant. Sometimes, this process takes quite a long time and affects patients' well-being and performance of their daily physical exercises. The patients who are chronically hemodialysed lead a sedentary lifestyle. They are not only very inactive during the inter-dialysis period, but also remain immobilized during dialysis for many hours a week, as well as during travel time to undergo dialysis. The ill patient spends on average approximately 500–800 hours per year on dialysis alone. Additionally, commuting to a place where dialysis is performed takes about 400–500 hours per year. Physiotherapist's planned training also contributes to the problem. Theoretically, kinesis therapy could be conducted between dialyses or in the period around dialysis. Unfortunately, dialysed patients mostly feel bad during this period. These factors limit the possibilities of physiotherapy in this group of patients. The only solution is to perform simple exercises during dialysis, which will not involve large joints, but rather help them to relax. We speak here about the exercise of the distal parts of the lower limbs and breathing exercises [22].

**Qualification to transplantation**

To have a better quality of life associated with a graft of a new viable organ, patients in Poland must undergo a qualifying procedure for transplantation and be placed on the so-called National Waiting List (KLO) of Poltransplant, a national organization coordinating removal and transplantation of organ. The patient's personal and medical details are placed on the National Waiting List for renal transplantation after having been qualified for kidney transplantation. Waiting time ranges from 1 to several years, but varies widely, depending on the number of organs available for transplantation and individual characteristics of the recipient. In most cases, patients undergo dialysis treatments. There are exceptions to this rule if organs are transplanted from living donors [22].

The techniques of kidney transplantation were developed several years ago. The operation usually takes 2–4 hours. The recipient's kidneys usually remain untouched if they were not previously removed. The new kidney is placed on the right or left side of the lower abdomen. In some cases, a patient is reimplanted with the old kidney failure. Usually, a drain is left near the kidney, passing through the skin outside the surgical wound and connected to the vessel receiving discharge fluid accumulating around the kidney. The amount and color of the fluid can vary on different days. The drain is usually removed a few days after the operation.

It should be remembered that at the beginning, the human body recognizes the transplanted organ as a foreign body, and the immune system reacts with an attack directed against graft. Immunosuppressive medicines that are administered are intended to prevent rejection of the kidney by weakening the immune system response. However, at the same time, these medicines cause the transplant recipient to become more susceptible to infections. Therefore, it is very important to maintain an appropriate balance between the inhibitory effect of rejection reaction and maintenance of the necessary capabilities to defend against infections. This issue is an equally important element in the process of rehabilitation where it is necessary to maintain absolute caution in contact with the patient and avoid unnecessary exposure to danger [23].

**Rehabilitation directly after the transplant of the kidney**

On the 1st day after the operation, the patient feels nauseous. Therefore, in this period, fluids or food are not administered orally, but only intravenously. The postoperative fasting period lasts until peristaltic bowel movements return. Sometimes, after surgery, it is necessary to perform an enema if problems with excretion exist. Physiotherapists' rehabilitation possibilities regarding the ill person's well-being are significantly limited and rely only on the performance of anticoagulant and breathing exercises. They are usually resistive breathing exercises, where breath is resisted by an aquatic environment. The patient can perform them individually during the day, after having been instructed by a competent person.

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During the first 12 hours after surgery, visits are usually contraindicated because patients feel ill, and precautions are taken to protect patients from infection. Patient needs relaxation and tranquility during this period.

It is important to try to get up and move around as soon as possible. The objective of early verticalisation is to prevent early thromboembolic complications, respiratory problems, and constipation. In this situation, the patient must be assisted by a physiotherapist who, by sequentially explaining the activities, slowly brings the patient to a standing position. The fear associated with pain makes it necessary to clearly explain to the patient what actions will be performed. On the next day a wider range of exercises involving the musculoskeletal system can be introduced. The patient learns to stabilize the postoperative wound only with the hands. For these patients, use of a stabilizing belt is contraindicated as it could constrict the thoracic cage, impairing the health status of the patient allows performing asymmetric movements of upper and lower extremities, as well as breathing exercises during breaks. The ill patient, if educated to cough correctly, can expectorate the accumulated bronchial secretions and prevent respiratory complications. Usually, the ill patient is advised to take a breath through the nose and blow out secretions during quiet coughing while stabilizing the postoperative wound. Learning to correctly cough may be preceded by inhalation of saline in order to facilitate expectoration. If there are no medical contra-indications, the patient should be encouraged to exercise moderately for about 30 minutes per day [7, 27]. Programmed physical exercise can increase muscle strength, reduce feelings of weakness, and increase independence in daily activities. Daily physical activity can be measured by pedometers. Fareze et al. [28] presented another alternative—the beneficial effects of electro-stimulation of the muscles of thighs and calves using TENS currents and physical exercise on a cycle ergometer. This method reduces the incidence of comorbidities in dialysed patients. Another proposal is exercises performed at various intensities in a universal rehabilitation office (UGUL). After finishing the exercise program, increased mean physical fitness was found by the modified Harvard test, showing increased physical exercise time and number of steps walked during a physical exercise test. In addition, the average daily physical activity, expressed by the number of steps measured with a pedometer, increased.

In the studies of Deligiannis et al. [29], even a 3-month physical exercise program of dialysed patients resulted in decreased vascular resistance and stiffness. In the studies of Miller et al. [30], a 6-month training cycle made it possible to reduce the demand for hypertension medications.

It is important to draw attention to the fact that, despite the positive aspects of physical exercises and awareness of patients, many patients stop exercising, explaining that they lack motivation or time. This issue is presented by Wnuk et al. [31], who found that as many as 52% of patients withdrew from the conducted exercises, despite their earlier statements of willingness to participate.

In 2005, the Polish Sports Association after Transplantation was established. The main objective of this organization is to promote the idea of transplantation through the promotion of physical activity and conscious donation of organs for transplantation. Encouraging exercise among those who underwent transplantation allows them to regain their physical condition before organ failure and allow dialysed patients to overcome the hardships of everyday life.

After mastering general rehabilitation and respiratory exercises, it is possible to try other forms of physical activities such as cycling, swimming, walking, tennis, and running as soon as 3 months after the operation.

The patients should consult their transplantation team physician before increasing physical effort.

Return to normal life is to a large extent conditioned by physical fitness. The exercises already carried out during dialysis constitute the basis for post-operative reha-

### Table I

<table>
<thead>
<tr>
<th>The authors of the research</th>
<th>Training cycle and its effects</th>
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<td>Koudi et al. [26]</td>
<td>Performing exercises on days without dialysis in varied environments lasting one year; improvements in maximum oxygen consumption - VO2max (47% vs34% practicing in dialysis centre) noted, as well as physical exercise time in a modified Bruce test (38% vs. 28%) increased</td>
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<tr>
<td>Deligiannis et al. [29]</td>
<td>6-month training cycle applied, an increase in stroke volume of the heart and its fractions observed; 3-month training reduced resistance and stiffness of peripheral vessels</td>
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<td>Miller et al. [30]</td>
<td>6-month training cycle made it possible to reduce the demand for overpressure medicines</td>
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<tr>
<td>Malagoni et al. [33]</td>
<td>6-month training in the form of walks taken twice a day for 10 minutes on days without dialysis at the speed of 50% of maximum attainable time during the monthly control test; after this time, general health condition and quality of life improved and the ailments occurring after dialysis reduced</td>
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<tr>
<td>Nowicki et al. [32]</td>
<td>3-month mid-dialysis training in the form of walks assessed with Harvard test, average physical fitness, physical exercise mean, time of effort and distance walked increased</td>
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<tr>
<td>Wnuk et al. [31]</td>
<td>5-month training cycle including breathing exercises, abdominal muscles strengthening, back muscles stretching and relaxation exercises</td>
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<td>Painter et al. [25]</td>
<td>Regular physical activity of dialysed patients, additional home exercises</td>
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bilitation. It greatly helps the physiotherapist if the patient has already begun to exercise, and this speeds recovery, which in turn impacts comorbidities and chronic kidney disease complications. The available literature analyzes most of the conditions before transplantation. Nowadays, with physiotherapy, intervention speed is important, as well as avoiding prolonged hypokinesia (staying in bed), which may result in thromboembolic complications, constipation, respiratory problems, and a general weakening of the body. The vertical position of the body enhances the activity of internal organs, enables the patient to return to independent activities, and improves quality of life. Therefore, post-operative rehabilitation is an integral part of the recovery of the patient after transplantation.

Conclusions

On the 3rd day after the operation, patients can sit upright if there are no medical contraindications. Regular supervised physical activity allows starting training with submaximal workload of no more than 80% VO2max.

References

13. www.renalrehab.com