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EFFECTS OF HOSPITAL REHABILITATION ON FUNCTIONAL STATUS OF POST COVID-19 PATIENTS

Rehabilitacja szpitalna a stan funkcjonalny pacjentów po przebytym COVID-19

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A - Koncepcja i projekt badania, B - Gromadzenie i/lub zestawianie danych, C - Analiza i interpretacja danych, D - Napisanie artykułu, E - Krytyczne zrecenzowanie artykułu, F - Zatwierdzenie ostatecznej wersji artykułu

Abstract (in Polish):

Cel pracy

W związku z tym, że skutki COVID-19 dotyczą wielu układów ludzkiego ciała, celem artykułu była analiza zmian zachodzących w stanie funkcjonalnym pacjentów, którzy poddani zostali programowi rehabilitacji w okresie pół roku od zachorowania na COVID-19. Ocena efektów rehabilitacji obejmowała wydolność fizyczną, sprawność funkcjonalną, ryzyko upadków, poziom samopoczucia, samoocenę w zakresie radzenia sobie z czynnościami dnia codziennego, a także ryzyko wystąpienia depresji.

Materiał i metody

Wykorzystaną metodą był sondaż diagnostyczny. Do technik należały: pomiar, wywiad, obserwacja bezpośrednia i pośrednia, ankieta, dokumentoskopia. Narzędziami użytymi w pracy były: kwestionariusz wywiadu, test marszu 6-minutowego, arkusz obserwacji, kwestionariusz ankiety, skala Borga, Test „Timed Up and Go", stoper, Geriatryczna Skala Oceny Depresji wg Yesavage'a i wsp.

Wyniki
Badania wykazały istotną statystycznie poprawę wydolności pacjentów oraz zmniejszenie stopnia zmęczenia wg skali Borga. Znacząco poprawiła się jakość przemieszczania się i zmniejszyło się ryzyko upadków. Po przebytej rehabilitacji pacjenci wyżej ocenili swoją sprawność podczas wykonywania czynności dnia codziennego, które wymagały umiarkowanego wysiłku fizycznego. Istotnie statystycznie zmniejszyło się ryzyko wystąpienia depresji.

Wnioski
Uzyskanie tych wyników po okresie usprawniania stanowi pomyślne rokowanie w powrocie do pełnej sprawności funkcjonalnej pacjentów. W ocenie efektów rehabilitacji należy poza sferą fizyczną uwzględniać także sferę psychiczną każdego człowieka. Im lepsze efekty rehabilitacji zostaną uzyskane zarówno w aspekcie fizycznym, jak i psychicznym, tym lepszy będzie ogólny stan funkcjonalny pacjentów.

Abstract (in English):
Aim
Due to the fact that the effects of COVID-19 affect many systems of the human body, the aim of the article was to assess changes in the functional state of patients, who have been admitted to rehabilitation ward no longer than six months after recovery from COVID- 19. Assessment involved physical capacity, functional capacity, risk of falls, well-being, self-esteem according to activities of daily living, risk of depression.

Material and methods
Method used in the study was a diagnostic survey. Techniques included: measurement, interview, direct and indirect observation, questionnaire, documentoscopy. Tools used in the study were: interview questionnaire, 6-Minute Walk Test, observation sheet, survey questionnaire, Borg Scale, Timed Up and Go Test, stopwatch, the Geriatric Depression Rating Scale according to Yesavage et al.

Results
The research showed statistically significant improvement in the efficiency of patients and reduction of fatigue, according to the Borg Scale. The quality of moving has significantly improved and the risk of falls has decreased. Patients rated their fitness higher in performing everyday activities. The risk of depression has decreased statistically.

Conclusions
Outcomes after rehabilitation programme indicate that return to functional fitness of the patients is possible. In assessing the effects of rehabilitation, apart from the physical sphere, the mental sphere of each person should also be taken into account. The better results of rehabilitation are achieved both in physically and mentally sphere, the better the general functional state of the patients will be.

Keywords (in Polish): wydolność fizyczna, sprawność funkcjonalna, ryzyko upadków, ryzyko depresji, czynności dnia codziennego.

Keywords (in English): physical capacity, functional capacity, risk of falls, risk of depression, activities of daily living.

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Short title
Stan funkcjonalny pacjentów po przebytym COVID-19

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Introduction

At the end of 2019, the whole world was confronted with the SARS- CoV-2 virus, which most commonly affects the respiratory, cardiovascular, gastrointestinal, urinary and genital systems, as well as causing skin lesions [19]. According to WHO data, the most common symptoms are fever, cough, fatigue, and loss of smell or taste. Less common symptoms include sore throat, headache, muscle aches, diarrhoea, skin rash, discolouration of the fingers and toes, and red, irritated eyes. In addition to the more-or-less common symptoms, the WHO pays special attention to one more type of symptoms, which are defined as „severe". These are classified as: difficulty breathing or shortness of breath, loss of speech, mobility, disorientation, and pain occurring in the chest [22]. A tendency for the condition to worsen in the second week of illness has been observed, usually occurring five to 10 days after the onset of the first symptoms [16]. The main causes of mortality from COVID-19 include respiratory failure (69.5%), septicaemia or multiple organ failure (28%), heart failure (14.6%) and renal failure (3.7%). Clinical signs of COVID-19 infection can be observed 5-6 days after incubation. The time varies, however, depending on the age and immune function of the infected person [13]. The majority, about 80%, of COVID-19 infections are in the form of mild respiratory disease and such patients can be treated mostly without hospitalisation. Approximately 15% of patients require hospital care. This is usually the case with moderate to severe pneumonia. In 5% of infected patients, there is a critical course of the disease requiring more intensive support, including a stay in the Intensive Care Unit [16]. Depending on the severity of the course of COVID-19, the physical condition of individuals following the disease varies. The limitations that can be expected among patients in hospital are mainly due to permanent immobilisation in the supine position. There is then a weakening of muscle strength, so that sputum excretion decreases, and there is also an increased risk of deep vein thrombosis. Neuromuscular complications, stiffness and joint pain, and even dysphagia are also common. Patients also have difficulty with balance, standing and walking, indicating a significant reduction in mobility and a tendency to have frequent falls [24]. Studies show that hospitalised patients with COVID-19 immediately after hospital discharge are characterised by an impairment in the performance of activities of daily living. Several months after infection, a subgroup of patients with COVID-19 continue to report persistent symptoms such as fatigue, shortness of breath and muscle weakness, as well as reduced quality of life and increased reliance on others for personal care and to perform daily routine activities [3]. It should also not be forgotten that, along with high rates of infectiousness and mortality, the COVID-19 pandemic has affected the psychological sphere of society as a whole. There is probably no one who has not or will not experience the impact of coronavirus on their lives. Nadezhda Soloveva et al. believe that the pandemic has a much more extensive impact on the mental sphere than on the somatic sphere of people. However, the true scale of the problem will only be fully described once the pandemic is over, as mental disorders will appear in both recovered and healthy individuals at different times. So far, the occurrence of post-traumatic stress disorder (PTSD), depressive episodes, neurotic disorders or personality disorders, among others, has been reported. The emergence of such dysfunctions is defined as , 'covid syndrome'. It is a psychological response to a global pandemic problem. Groups at risk for this include health care workers who have worked in COVID units, patients who have had a severe course of illness, those who have lost loved ones and those who have suffered significant financial losses or lost their jobs [14]. The occurrence of such disorders may be due to both the immune response to the virus itself and psychological stressors, such as social isolation, awareness of the emergence of a new, severe and potentially fatal disease, or simply fear of infecting others [11]. With so many mental health disorders, detailed diagnosis and appropriate care should be implemented in this area as well.

With regard to the methods and goals of rehabilitation for patients after COVID-19, it should be noted that there is a great deal of variation within the group, both in the sick and the recovered. Therefore, caution must be exercised when planning rehabilitation. Completely different therapeutic measures will be able to be taken for those in hospital, compared to those measures that can be implemented in, for example, recovered patients. This indicates the necessity to adapt rehabilitation to the current state of the patient, but also to the so-called time frame in which he or she has been in since becoming ill [23]. In order to effectively plan the improvement process, it is worth noting that the variety of damage caused by COVID-19, often in combination with pre-existing chronic diseases that many patients will suffer from, indicate that there is no one specific rehabilitation method. At present, there is a lack of detailed knowledge about the prognosis after COVID-19, so decisions should be made on the assumption that long-term irreversible damage will be relatively rare and that recovery will occur within 12-24 months, even for those who have experienced an acute course of disease. After COVID-19, most, but not all, patients will need pulmonary rehabilitation. It aims to alleviate symptoms of dyspnoea, anxiety and depression, reduce complications, prevent the occurrence of further dysfunction, maximise preservation of function and improve quality of life [3].

Exercises that use muscle work and increase cardiorespiratory load will also be extremely important. These are beneficial not only for general fitness, but also for problems of a psychological nature, such as fatigue, emotional disturbances and lack of confidence. This is an essential element of any cardiac and respiratory rehabilitation, so it should be encouraged from the outset. Psychosocial support is another important aspect identified in almost all studies that demonstrates the effectiveness of rehabilitation. It is not precisely defined, but usually refers to coping skills such as emotional distress, changes in self-esteem and self-confidence. It includes techniques such as cognitive behavioural therapy or motivational interviewing [20].

The aim of the self-study presented in this article was to assess changes in the functional status (physical and psychological) of patients after COVID-19 under the influence of hospital rehabilitation. The evaluation included the following characteristics: gait capacity, level of effort expended to perform activities, functional fitness and risk of falls, and well-being.

Material and methods

The following research problems were formulated prior to the study:

1. Did the hospital rehabilitation programme have a significant effect on the physical performance of the patients?
2. Is there a correlation between having undergone a hospital rehabilitation programme and improved quality of movement?
3. Has the hospital rehabilitation programme made it easier for the patients to perform activities of daily living (in their subjective assessment)?
4. Did the past rehabilitation programme have a significant impact on the risk of depression?

The research method used was a diagnostic survey; the research techniques used were measurement, observation and a questionnaire. The tool used to assess gait capacity was the 6-minute walk test (6MWT). Circulatory parameters (heart rate and blood pressure) were measured before and after the test. After the test, the patient subjectively assessed the amount of effort expended to perform the activity on the Borg scale. The norm is for the patient to walk a distance of approximately 700 m; if the patient walks less than 300 m, this indicates a poor prognosis. The Timed Up and Go Test (TUG) was used to assess functional capacity and risk of falls. Completion of the test in less than 10 s is the norm and is taken as an indicator of full motor independence. The Geriatric Depression Rating Scale (GDS) by Yesavage et al. was used to assess patients' well-being. With a score of 0-15, a normal state is indicated by a score of 0-5, above this value we are dealing with moderate depression (scale of 6-10 points) or severe depression (11-15 points). A self-administered questionnaire was used to assess difficulties in performing activities of daily living.

Inclusion criteria for the study group were: a history of COVID-19 in the last 6 months prior to the start of the study, deterioration in functional status compared with the pre-morbid period, consent to participate in the study and anonymous publication of results. Patients who had COVID-19 disease in the period earlier than 6 months before the study were excluded from the study.

The study was performed at the Independent Public Complex of Tuberculosis and Lung Diseases in Olsztyn. Each study was conducted twice - on the day of the start and end of a 3-week rehabilitation camp. Breathing exercises combined with morning gymnastics took place after breakfast and lasted 15 minutes. The duration of the treadmill and stationary bike exercises was 30 minutes, while the upper limb rotor exercises were performed in three series of 50 repetitions each. All patients were required to take their own walks. Depending on their current mood and level of fitness, the time allocated to this activity varied. Mostly, patients walked for about 30-60 minutes. The set of the above exercises was performed six times a week.

The T-test for dependent samples from the Statistica 10 package was used for statistical calculations.

Study results

The study group comprised 33 patients enrolled in the hospital rehabilitation programme - 19 women and 14 men. Patients ranged in age from 45 to 86 years, with a mean age of 67 years. The BMI ranged from 22.2 to 30.9, with an average of 30.9±4.93. The majority of patients (64%) had a BMI indicative of obesity (Figure 1), with a normal weight-to-height ratio recorded for only 15% of the subjects.

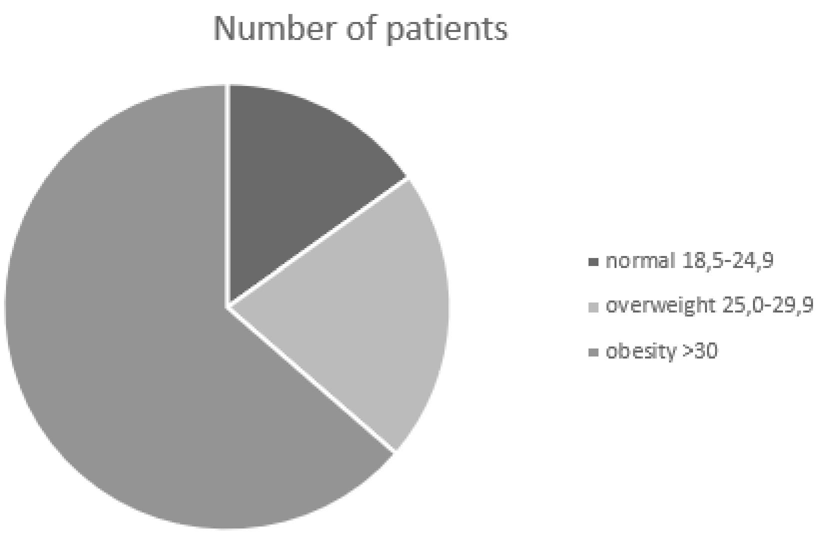

Figure 1 Differentiation of the study group in terms of BMI.

Fifty-eight per cent of the patients were hospitalised for COVID-19; the duration of hospitalisation ranged from 1.5 to 12 weeks, the most common being 2 weeks. More than half of the patients needed oxygen, only 3 patients were under ventilator. The symptoms of the disease were varied (Figure 2), from a physiotherapy point of view the most relevant were: muscle and joint pain, shortness of breath, general severe weakness, rapid fatigability.

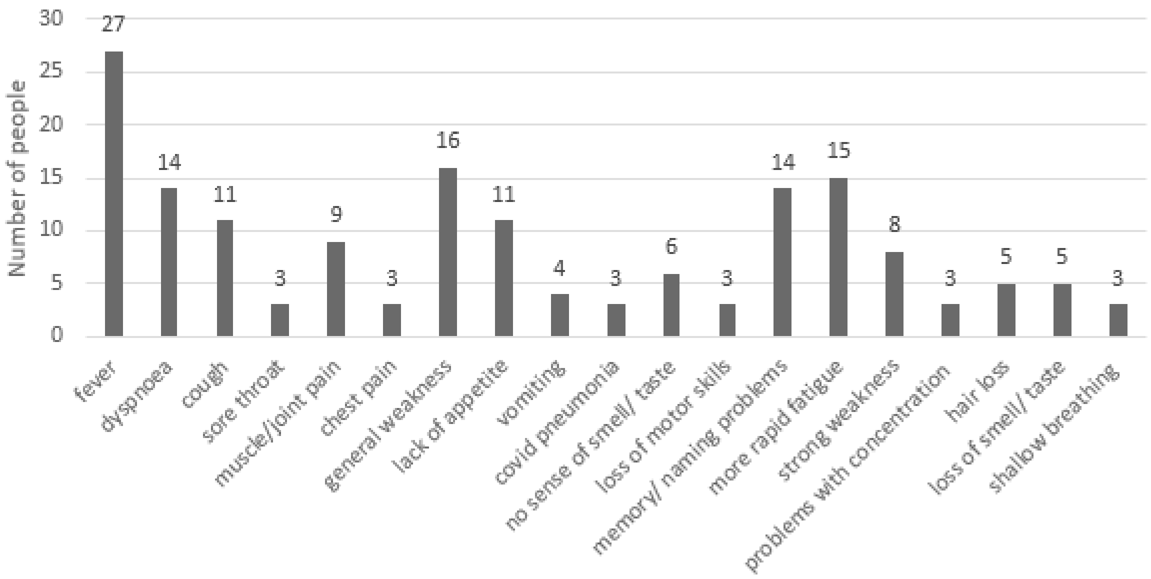

Figure 2. The most common symptoms accompanying SARS-CoV-2 virus infection in the study group

The physiotherapy programme included breathing exercises, combined with morning gymnastics, treadmill exercises, stationary bicycle exercises, upper limb rotor exercises and walking. Due to the different capacities of the patients, the type of exercises and their intensity were selected individually. The patients' stay at the rehabilitation unit lasted three weeks.

To answer the first research question - whether the in-patient rehabilitation programme had a significant effect on the patients' physical capacity - the results of the 6-minute walk test were compared.

Prior to rehabilitation, the minimum 6-minute walk test (6MWT) score was 165 m and the maximum was 610 m. On average, patients covered a distance of 429 ± 103.00 m, which is well below normal. After rehabilitation, the test results increased, the smallest distance covered was 180 m and the largest was 620 m, with an average of 467 ± 102.42 m. The differences proved to be statistically significant, p = 0.000002 (Table 1), while it should be noted that none of the patients reached the 700 m standard. Improved results after rehabilitation represent a successful prognosis.

Table 1. Comparison of the results of the 6-Minute Walk Tests

Variable	T-test for dependent samples. Marked differences are significant with p < .05000	
	Mean ± Standard deviation	p
6MWT before rehabilitation	429,330 ± 103,0068	0,000002
6MWT after rehabilitation	467,152 ±102,4296	

The hospital rehabilitation programme had a significant effect on subjective fatigue ratings according to the Borg scale during the marching test (Table 2). Before rehabilitation, fatigue was assessed as light to moderate, whereas after the improvement process, fatigue was assessed as very light to moderate. A comparison of fatigue scores before and after rehabilitation showed statistically significant differences, p = 0.002074.

Table 2. Subjective assessment of fatigue according to the Borg Scale

Variable	T-test for dependent samples. Marked differences are significant with p< ,05000	
	Mean ± Standard deviation	p
Fatigue after 6MWT before rehabilitation	2,182 ± 1,8278	0,002074
Fatigue after 6MWT after rehabilitation	1,182 ± 1,8448	

Another of the research questions concerned the relationship between the hospital rehabilitation programme undergone and the patients' improvement in quality of movement.

Before rehabilitation, the minimum time to complete the Timed Up and Go (TUG) test was 3.9 s and the maximum time was 15.2 s. This demonstrates the varying functional status of the patients, some of whom showed independent mobility only in simple motor transfers. The mean of the measurements before hospital rehabilitation was 8.252.260. The hospital rehabilitation programme significantly affected the speed of distance covered when performing the TUG test (Table 3). After rehabilitation, the minimum time to complete the test was 3.6 s and the maximum time was 12.3 s, while the average after rehabilitation was 6,871,766. The differences proved to be statistically significant (p = 0.000001). The test was performed faster after undergoing the hospital rehabilitation programme, which is a successful prognosis. This also indicates a reduction in the occurrence of the risk of falling during activities of daily living. This is an important aspect both physically and psychologically, improving functional comfort.

Table 3. Comparison of TUG test results

Variable	T-test for dependent samples. Marked differences are significant with p < .05000	
	Mean ± Standard deviation	p
Depression propensity before rehabilitation	8,2491 ± 2,2600	0,000001
TUG after rehabilitation	6,8673 ± 1,7657	

The study also included a psychological aspect, looking for an answer to the question - did the past rehabilitation programme make the risk of depression lower?

Before starting rehabilitation, the minimum number of points scored after completing the Geriatric Depression Rating Scale by Yesavage et al. was 0, the maximum was 11 points. The mean score measured before the start of improvement was 3.83 3.117. This means that the group was heterogeneous - some people had a low risk of depression, some had moderate depression. The in-patient rehabilitation programme changed the patients' subjective assessment of their psychological well-being, with scores ranging from 0 to a maximum of 5. The mean of the post-rehabilitation measure was 1.76 1.678. The differences proved to be statistically significant (Table 4). Patients were less prone to depression, which represents a successful prognosis. Before rehabilitation, 36% of the patients declared that they preferred to stay at home rather than go out and meet people, whereas after rehabilitation this rate decreased to 12%, indicating a better mental condition of the subjects.

Table 4. Assessment of propensity to depression

Variable	T-test for dependent samples. Marked differences are significant with p < .05000	
	Mean ± Standard deviation	p
Depression propensity before rehabilitation	3,8182 ± 3,1170	0,000012
Prone to depression after rehabilitation	1,7576 ± 1,6776	

The results obtained using standardised tools such as the marching test (6MWT), the test assessing functional fitness and risk of falls (TUG), the subjective assessment of fatigue in relation to the Borg scale, and the depression scale (GSD) allow an objective assessment of the results of the physiotherapy applied. No less important seems to be the patients' individual perception of their ability to function in everyday life. Therefore, the question was also posed as to whether the hospital rehabilitation programme influenced the patients' ability to perform activities of daily living more easily. The subjective assessment of the patients was that there was significantly less difficulty in doing housework, physical work and bending. Rapid fatigue and difficulties in getting dressed had completely disappeared (Figure 3). There was also a large decrease in balance problems, with 64% of patients affected before the improvement programme and 36% of patients affected after rehabilitation (Figure 4).

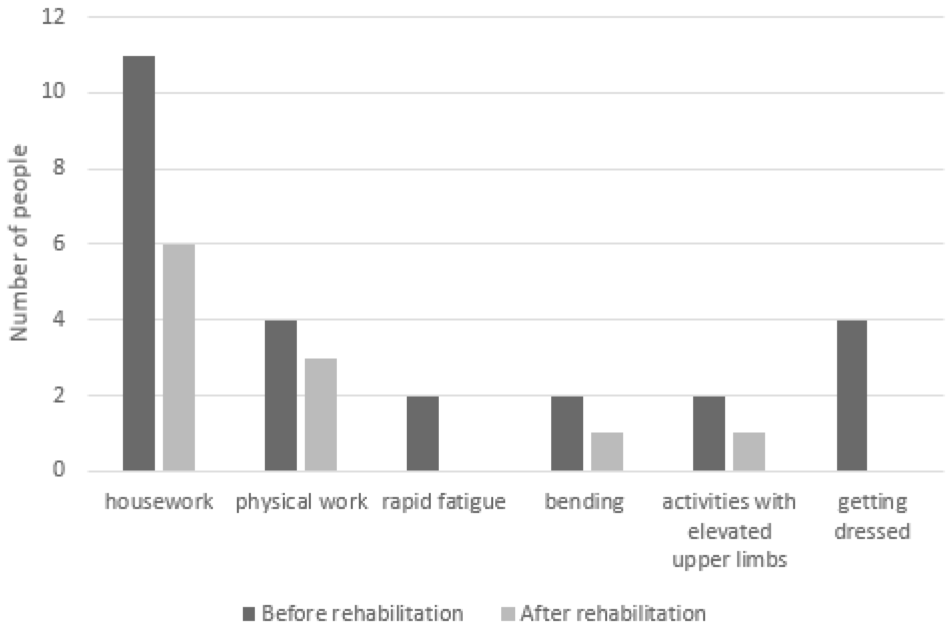

Figure 3. The most common difficulties in performing activities of daily living

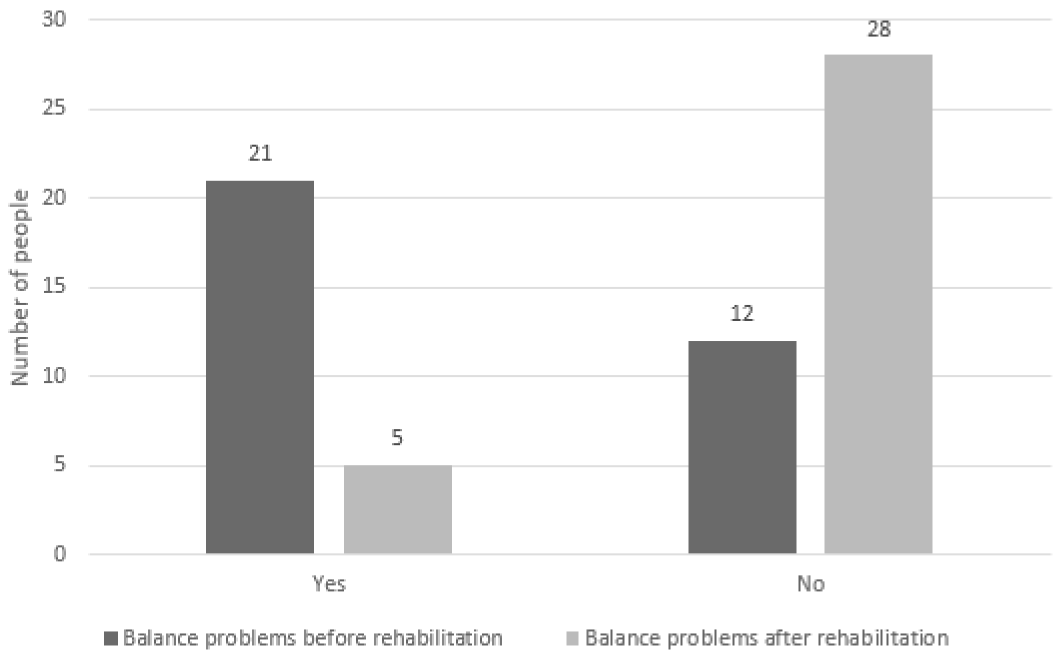

Figure 4. Prevalence of balance disorders before and after rehabilitation

Discussion

COVID-19 is characterised by multisymptoms, the effects of this disease affecting numerous organs in the human body. All the indications are that, for years to come after having contracted the disease, patients will continue to suffer discomfort, related to the deregulation of the body that has occurred as a result of contact with the virus. The most satisfactory way to improve would be to select clearly effective therapeutic interventions, and therefore, since the observation of increased incidence, the effectiveness of selected rehabilitation measures has begun to be analysed.

On the basis of our own research, we found that, as a result of a 3-week rehabilitation programme, patients after COVID-19 improved, among other things, their exercise tolerance and the fatigue accompanying the performance of the marching test decreased. Such a relationship was also recognised in their work by Maurio Maniscalco et al [10]. These authors analysed the effectiveness of multidisciplinary rehabilitation in two groups of patients - the first group was made up of patients who had COVID-19 and had previously been diagnosed with cardiorespiratory disease. The second group of subjects were post-COVID-19 patients without comorbidities. After rehabilitation, improvements in exercise tolerance were noted in both study groups. Such results suggest that rehabilitation after SARS-CoV-2 virus infection improves exercise tolerance regardless of previously present comorbidities. It should be noted that patients without concomitant diseases represented a better baseline before rehabilitation. The explanation for the improvement in exercise tolerance is relatively simple. For both the patients who took part in our study and those studied by Maurio Maniscalco et al [10], the rehabilitation programme included, among other things, breathing exercises and exercises to strengthen muscle groups, which were undertaken six times a week. The systematic nature of the sets of exercises performed and the gradual increase in intensity to the limit of individual tolerance, increased overall exercise tolerance, as reflected in the results obtained. The use of telerehabilitation in post-COVID-19 recovered patients presented in the work of Mara Paneroni et al. [12]. During admission and discharge, among other things, capacity was assessed based on distance covered in the 6MWT and dyspnoea assessment according to the Barthel Index Dyspnea (BI). Patients were given appropriate recommendations, a set of exercises and were provided with teleconsultation with a physiotherapist twice a week. In addition, they were telemonitored daily by nurses for the first two weeks to check on any clinical needs. After one month, the distance covered in the 6MWT had increased in 75% of patients. Perception of dyspnoea according to the Barthel Index Dyspnea decreased in up to 83.3% of patients. This indicates that effective rehabilitation can be carried out remotely and, therefore, perhaps more efficiently assist a large number of recovering patients without the need for long waits for outpatient rehabilitation. In the vast majority of published work, pulmonary function is assessed first before exercise tolerance is assessed. Although the 6MWT test and subjective fatigue assessment may provide some approximation of the quality of daily functioning, the results of objective, standardised tests, such as spirometry, are of particular value. This is evident in the study by Kai Liu et al [6]. The results obtained were divided into primary and secondary outcomes. The first group included respiratory function assessed by spirometry, while the second group included endurance assessed by the 6MWT, ability to perform activities of daily living, quality of life assessment, and mental status assessment. Assessment of changes in lung function during our study was unfortunately not possible. The procedure used at the institution where the study was conducted did not provide for a spirometry test to be performed at the time of patient admission to the ward and at the end of the rehabilitation programme. Patients had a single spirometry performed at different times after entering rehabilitation. Therefore, a comparative analysis was unfortunately not possible. With regard to the study by Kai Liu et al. only secondary measures can be referred to. The authors show statistically significant changes within the study group after undertaking 6-week pulmonary rehabilitation in the distance covered in the 6MWT, which increased in relation to the distance covered before the intervention. The above study therefore demonstrates that it is only possible to achieve a significant improvement in performance in the 6MWT after specifically selected and regularly performed breathing exercises. The effect of breathing exercises on the ability to perform daily activities more fluently was also investigated. In this case, no significant improvement was found. It can therefore be concluded that improvements in the quality of daily functioning need to be supported by a stronger, more functional rehabilitation intervention. In our study, the patients' subjective assessment of the difficulty in performing activities of daily living was significantly better after rehabilitation than before improvement. This was probably a result of the exercises applied, a specific daily rhythm, and daily programmed activities, which translated into the development of smoother movements, and a reduction in the effort required to perform individual activities. This is also evidenced by a statistically significant improvement in the speed of the TUG test. Movement limitations accompany a variety of diseases and dysfunctions, one of which is COVID-19. Manuel Cereda et al. highlight the problem of lack of physical activity taking and the increasingly common sedentary lifestyle in healthy elderly people whose way of functioning has been altered by the indirect effects of the SARS-CoV-2 virus. Fear of disease and awareness of being part of a group with an increased risk of disease proved to be a key factor in many cases in limiting contact with the outside world. The studies cited above identified this type of isolation as a factor predisposing to an increased incidence of falls risk. In their study, the authors indicate that a specially selected set of Kunte exercises, based on sequences of oriental-type movements, arranged in accordance with the theoretical and practical foundations of physiotherapy and the methodological and pedagogical principles of physical education, results in significantly better results in the dynamic assessment of body balance and gait after three months of performance.

The study group in Olsztyn consisted of patients, 42% of whom were treated for COVID-19 at home; there were 16 patients under oxygen during hospital treatment, and only three used a ventilator. At the start of the turnout, there were no significant differences in the functional status of patients hospitalised and treated at home. The effect of the duration of hospitalisation on physical performance is presented by Liam Townsend et al [18]. In their paper, they demonstrate that persistent poor health after COVID-19 is not associated with respiratory complications or initial disease severity. Among the 109 patients who completed the 6MWT, the median distance covered was 460 m. The longer the patients' hospital stay, the statistically significantly shorter the distance in the 6MWT. Interestingly, however, the number of metres covered was not related to the initial severity of the disease. The median score obtained according to the Borg scale was 3. Maximum perceived exertion scores were also independent of initial disease severity.

The course of COVID-19, particularly in its severe form, results in the occurrence of physical impairments associated with akinesia. These include muscle weakness, joint stiffness, (neuro) psychological disturbances, impaired mobility, difficulties in performing activities of daily living and functioning in working life [7]. Therefore, it is important to implement active mobilisation and rehabilitation as early as possible, as this can improve mobility status, muscle strength and quality of life in later stages of improvement. According to Claire J. Tipping et al. [17], the use of this type of intervention can already start during intensive care unit (ICU) care. However, it should not be forgotten that patients who have been hospitalised during COVID-19 have a cytokine storm and a whole range of disorders of a systemic nature [23]. This means that the organisms of these individuals with also need to be calmed down and regulated as the autonomic nervous system is stressed. The disease starts in the lungs, but leads to a disruption of the entire control process of the endocrine system, as well as the various processes managed by the autonomic nervous system. Therefore, when working with a patient after COVID-19, therapeutic measures must be applied in the safest possible way for the patient. To this end, an international task force coordinated by the European Respiratory Society and the American Thoracic Society developed interim guidelines for rehabilitation in the in-hospital and post-hospital phase [Spruit et al., 2020]. The majority of the experts referenced strongly (55%) or conditionally (37%) recommended that hospitalised patients with COVID-19 should be rehabilitated in bed/at the bedside (critical care and/or on the ward) until safe discharge home. This may prevent and/or slow down the expected rapid deterioration in physical function and emotional condition. Some experts have expressed concerns about patient safety due to limited understanding of the underlying pathophysiology and the possible impact of rehabilitation interventions. It is unclear whether there is a 'disease severity threshold' or any specific disease characteristics that place patients at greater risk of harm when undertaking rehabilitation interventions during hospitalisation. This is particularly important if only because of the risk of thrombosis, including microthrombosis and venous thromboembolism. The recommendation to mobilise and activate as early as possible is disagreed with by Anna Pyszora [23], who believes that patients in the acute phase of COVID (i.e. 4 weeks after infection) should not undergo physiotherapy. This time of illness is the period in which the patient is expected to survive with as few complications as possible and as comfortably as possible, in the hope that an ICU stay will not be necessary. Rehabilitation should start when symptoms start to prolong. However, a period of 4-12 weeks is the time when a number of symptoms are still associated with the effects of the SARS-CoV-2 virus on the body. It is only after 12 weeks, if symptoms still persist, that one should start to treat this as some kind of pathological situation, commonly referred to as „long COVID". In contrast, the International Task Force suggests that patients with COVID-19 should be encouraged to do low/moderate intensity exercise at home as early as the first 6-8 weeks after discharge from hospital [15]. Experts also point out that SARS-CoV-2 virus infection is associated with a high inflammatory burden, which may persist beyond the hospital discharge period. However, moderate-intensity training is safe and feasible in survivors of critical illness [4]. In contrast, the safety of high-intensity exercise in patients recovering from COVID-19 to date is unknown. In the early post-hospital period, it is not always possible to carry out a reliable exercise assessment or provide supervised rehabilitation services, especially when the healthcare system has to focus primarily on saving patients' lives. According to experts, undertaking moderate exercise in the 6-8 weeks following an illness may carry many more potential benefits than risks. This is why it is so important to know the period of hospitalisation and the time lapse since infection, because as therapists we need to be aware of when we are working with the patient, ask about the timing of symptoms, and then take action in the context of a specific timeframe regarding whether it is a „long COVID" or a situation where we are optimally allowing the patient to return to form [23]. Additionally, Anna Pyszora [23] points out that when working with patients after an ICU stay, it is important to remember that these individuals have been given large amounts of medication, including muscle relaxants and glucocorticosteroids, which affect the condition of muscle tissue and bone. This means that for those who have been in the ICU, we can expect long-term effects, while it may take several months or even years for the patient to recover. The views of the various researchers outlined above require further detailed research.

The main symptoms associated with SARS-CoV-2 virus infection mentioned by the patients we studied were fever, general weakness, more rapid fatigue, shortness of breath, speech problems, cough and lack of appetite. In a study by Nanshan Chen et al [2], they list the following clinical symptoms: fever, cough and shortness of breath. Muscle aches, confusion, headache and sore throat were indicated by patients much less frequently. This indicates a similar course of infection and provides further clinical information. The study also noted the presence of imaging assessment. The International Task Force also suggests that follow-up of a hospitalised patient with COVID-19 should include measurements of respiratory function 6-8 weeks after hospital discharge [15]. Respiratory function tests are essential to document ongoing impairment and guide future treatment, but are considered an aerosol-generating procedure, which may limit their availability in the COVID-19 era. However, their presence could significantly improve rehabilitation efforts. If not picked up in time, respiratory deficits could eventually develop into a new type of chronic disease. The data obtained as a result of this study, indicate the need to look at the patient's recovery process after COVID-19 in more detail than just from a physical perspective. The psychological condition of patients is important in their recovery. Our results indicated that a hospital-based rehabilitation programme had a statistically significant effect on reducing the risk of depression. It is important to remember that COVID-19 treatment was accompanied by isolation; patients often stayed for long periods of time without direct contact with relatives. In the rehabilitation ward, patients participated in group activities and stayed in rooms with several people. The observations of the study group showed that the patients felt comfortable in each other's company and even became very close to each other.

Different results were presented by Kai Liu et al [6]. They demonstrated that six weeks of pulmonary rehabilitation could affect less anxiety in elderly patients with COVID-19, but had a small but significant improvement for depression. This may be due to the fact that the study group was much larger and did not have any closer relationships with each other. The International Task Force suggests that psychological assessment of patients should be implemented as early as 6-8 weeks after discharge from hospital [15]. A similar position is presented by Sandra Dijkstra-Kersten et al [5]. Their rationale is that typical symptoms reported one year after leaving the ICU, including by patients with acute respiratory distress syndrome, are anxiety, depression and post-traumatic stress disorder. A study by Xiangyu Kong et al [9] found that for post-COVID-19 patients, especially those hospitalised, this is compounded by emotional stress, which is probably related to isolation from the immediate environment. They found that, of the 144 people studied, hospitalised and concomitantly infected with SARS-CoV-2, 34.7 per cent and 28.5 per cent of patients had symptoms of anxiety or depression, respectively. Bivariate correlations showed that lower social support was correlated with higher anxiety. This demonstrates the need to implement a mental health diagnosis. Problem solicitation and appropriate intervention are essential elements of clinical care for people at risk of developing mental health disorders. An element that supports the ability to cope with isolation and loneliness may be the use of virtual reality in the improvement process [8]. This study aimed to test whether patients and medical staff would receive potential health benefits after participating in virtual reality sessions involving three categories of experiences: guided meditation, exploration of natural environments and cognitive stimulation games. The programme implemented has been evaluated as highly satisfactory with perceived benefits by participants. The use of virtual reality is therefore, on the basis of this study, useful in coping with isolation and loneliness, and can be implemented in the context of clinical care for COVID-19 patients as part of a comprehensive rehabilitation model. However, a major disadvantage of using the above method is the high cost of purchasing the necessary equipment, which is certainly the reason for the lack of implementation of modern technology into daily improvement practice in most hospitals.

Summarising our own research and that presented in the recent literature, it can be concluded that the selection of therapeutic interventions proved effective in the sphere of functional assessment. However, there are studies in the available literature that show a number of approaches that were equally effective, but not used by the hospital where our own study was conducted. Kuo-Chuang Wei et al [21] place particular emphasis on a well-structured and multidisciplinary approach to patient rehabilitation. The patients they described received occupational therapy in addition to physiotherapy. Those who had persistent speech disorders were able to receive speech therapy. In addition, the clinical care module w as enriched by recommending low-intensity and multiple repetition exercises according to instructional videos and photographs. Balance training was introduced as a separate form of therapy. In the hospital-based rehabilitation that our study group underwent, no such measures were used. Patients had access to medical care, nursing care and supervision by physiotherapists, but there was no occupational therapy or cooperation with a speech therapist, psychologist or dietician. Expanding the team to include occupational therapists would be beneficial in that they would be involved in improving the performance of activities of daily living and educating patients.

Conclusions

1. After rehabilitation, the results of the walking test (6MWT) improved significantly, but the patients did not reach the norm (700 m). The reported improvement in physical performance represents a successful prognosis, but further rehabilitation is required.
2. The subjective fatigue score (on the Borg scale) was statistically significantly reduced during testing, indicating an increase in exercise tolerance prior to the improvement process. This may be a motivating element for patients to undertake not only further rehabilitation, but above all daily physical activity.
3. After completion of the in-patient rehabilitation programme, the Timed Up and Go Test (TUG) was performed faster, indicating a reduction in the occurrence of the risk of falling during activities of daily living. This represents a successful prognosis in patients' functional recovery and has a significant impact on improving safety and functional comfort.
4. The in-patient rehabilitation programme significantly altered the subjective assessment of psychological well-being - patients were less prone to depression and more willing to participate in social life. In assessing the effects of rehabilitation, in addition to physical functionality, the psychological aspect should also be taken into account, as only the combination of both elements indicates the functional status of the patient.

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