

## THE ROLE OF PULMONARY REHABILITATION BEFORE AND AFTER LUNG TRANSPLANTATION

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### Summary

Pulmonary rehabilitation is the key component in treating patients with chronic respiratory diseases. In lung transplantation program it plays an important role as an individualized program for every patient before and after surgery. In these patients reduced ability to exercise is an important predictor of outcome and survival after surgery so feature of pulmonary rehabilitation is immensely important. The intensity of exercise and training regimen depend on the underlying disease. Pretransplant rehabilitation helps optimize and maintain patient's functional status and supplies important interdisciplinary information about the following surgery. It also includes psychosocial support to patients and their caregivers with the goal to reduce stress and improve adjustment while waiting for operation. Posttransplantation rehabilitation starts in the first 24-48 hours after surgery and it is oriented to optimal lung expansion, airway hygiene, efficient breathing, extremity activation and walking. Educational component of the posttransplantation rehabilitation includes teaching recipients about desired health behaviors, risks, adequate medical regimen and healthy diet. Psychosocial support after transplantation involves: helping recipients to recover lost social and family roles, counseling, adapting to new organ and ongoing medical necessities, long-term moderation of their expectations and caring about their psychological wellbeing.

**Keywords:** pulmonary rehabilitation; lung transplantation; psychosocial support.

Pulmonary rehabilitation has been recognized as a key component in the treatment of patients with chronic respiratory diseases [1]. It is an established procedure in chronic obstructive pulmonary disease (COPD) [2]. Patients with other types of chronic respiratory diseases also have benefit from pulmonary rehabilitation [3].

Despite optimal medical treatment they all have the same problems; suffer from daily symptoms, muscle weakness, exercise intolerance, impaired mood status, poor physical activity and low quality of life. Positive effects of exercise-based pulmonary rehabilitation have been proved in patients with lung cancer (pre-/post-lung resection), chronic respiratory failure due to kyphoscoliosis, pre-/post-lung transplantation, cystic fibrosis, bronchiectasis, severe respiratory failure receiving extracorporeal membrane oxygenation, interstitial lung disease, and pulmonary arterial hypertension. Pulmonary rehabilitation programmes should be adapted to all the patients with chronic respiratory disease other than COPD [4].

Pulmonary rehabilitation provides evidence based assistance with the purpose of the best medical care for patients. New ATS / ERS recommendations (American Thoracic Society / European Respiratory Society Statement) on pulmonary rehabilitation from 2013 aimed that using international scientific expertise, new knowledge and clinical experience of experts in this field.<sup>1</sup>

The new ATS/ERS definition of pulmonary rehabilitation is: „Pulmonary rehabilitation is a comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies which include, but are not limited to, exercise training, education and behaviour change, designed to improve the physical and psychological condition of people with chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviours“ [1].

The objective is long-term improvement through the observance of such healthy behaviours. Changing behaviour is vital for optimization and improvement of health status in patients with chronic respiratory diseases because it reduces the number of interventions. Pulmonary rehabilitation is recognized as the leading strategy to achieve this goal.

Certainly, the exercise is still the basic for rehabilitation, but there is one important role of pulmonary rehabilitation, that is encouraging the ability of patients to engage in collaborative self-management treatment of their disease. This is actually a shift from the traditional didactic model of education and a move towards interactive consultation and involvement of patients in the active control of their disease [2].

### **Pulmonary rehabilitation program**

Pulmonary rehabilitation can be initiated in a stable phase or immediately after the disease exacerbation to reduce symptoms, increase physical activity, promote the independence of patients, increase participation in everyday activities and to improve the quality of life. The indication for pulmonary rehabilitation is not only based on the severity of lung disease, but also of the long-term persistence of symp-

toms, inability to perform daily activities and overall disabilities. The program must be carried out by well-trained interdisciplinary team consisting of: pulmonologist, respiratory therapist, occupational therapist, respiratory nurses, social workers, nutritionists, psychologists and family physicians. The goal of pulmonary rehabilitation is to improve quality of life with emphasis on: learning breathing techniques, respiratory muscles exercise, upper and lower extremities exercise, disease education, psychosocial support, smoking cessation, oxygen therapy, bronchodilator therapy, antibiotics and nutritional support. There is a proven effectiveness of different forms of exercise as part of pulmonary rehabilitation involving interval training, strength training, training of the upper limbs and transcutaneous neuromuscular electrical stimulation [1].

It is well known that patients with chronic respiratory diseases have a significantly higher respiratory work and also greater work of the respiratory muscles compared to healthy person which is particularly visible during physical exercise. Electrophysiological changes that occur during exercise in the respiratory and skeletal muscles are responsible for the lower exercise tolerance. The purpose of inspiratory muscle training (IMT) is to reduce the weakness of the respiratory muscles and improve exercise tolerance. Successful training of respiratory muscles should increase the maximum ventilation during exercise and improve exercise capacity [1].

In pulmonary rehabilitation exercise tolerance is estimated from clinical tests: six minute walking test (6MWT) or cardio pulmonary exercise testing (CPET) at the beginning and end of the program [1]. Nordic walking is feasible, simple and effective in carrying out the training, significantly increases the length of the walking distance (measured from the 6MWT) and has a positive impact on the daily physical activity in patients with chronic lung disease. Nordic walking is a safe physical activity also in end-stage lung disease, including patients waiting for lung transplantation, which leads to improved mobility and quality of life [5].

### **Pulmonary rehabilitation and lung transplantation**

Pulmonary rehabilitation plays an important role in lung transplantation program in terms of individual programs made for each patient before and after the transplant. [6] Before transplantation, pulmonary rehabilitation can help patients in optimizing and maintaining their functional status and can provide the interdisciplinary information about upcoming surgery, postoperative treatment, supervision after surgery and potential complications. In these patients reduced ability to exercise is an important predictor of outcome and survival after surgery, and therefore the role of exercise as a part of pulmonary rehabilitation is very important [7]. Intensi-

ty of exercise and training regimen depends on the underlying disease for which the patient was referred to lung transplantation. Some patients have a very poor effort tolerance and bad constellation of respiratory gases and require low-intensity exercise or interval training. During the exercise, blood pressure, pulse and oxygen saturation are monitored at all times. The aim is to create a really good partnership and communication between patient and pulmonary rehabilitation team thus detecting potential problems and enabling the adjustment of each patient to exercise and other parts of pulmonary rehabilitation program.

The educational component of pulmonary rehabilitation involves teaching patients about risks and benefits of operation, issues relating to care in the postoperative period (controlled cough, techniques of expectoration, wound care ...). It is also very important explain the risks and benefits of immunosuppressive therapy, and plan the necessary visits after transplantation for the purpose of monitoring and control testing.

Some authors studied the effect of interval training in relation to continuous training in candidates for lung transplantation with COPD. Interval training was associated with a lower degree of dyspnea during exercise and less unwanted breaks, but achieved similar improvements in exercise capacity compared with continuous training [7].

Low effort intolerance and functional disability often persists after the lung transplantation, despite the renewal of lung function parameters (normal or near normal) and better constellation of respiratory gases. Skeletal muscle dysfunction plays an important role in such functional disability [9-11].

Muscle weakness that is present preoperatively may worsen during the first weeks after transplantation [11] and may be present up to 3 years post-transplant 12-15 and the maximum capacity of exercise can be reduced to 40-60% of the estimated up to 2 years after transplantation [16-17]. Immunosuppressive drugs may worsen muscle function [17].

Rehabilitation begins in the first 24-48 hours after surgery and is focused on the optimal expansion of the lungs and secretion clearance of respiratory tract as well as the effective breathing, and starts the activation of upper and lower extremities (range of motion, strength and basic transmission for walking). The necessary precautions have been taken to intensive aerobic exercise, especially involving the upper limbs, because it takes 4-6 weeks for the healing of postoperative incision. As the muscular strength and endurance gradually improves, patients may ultimately bear a greater intensity than they were able to achieve preoperatively, because now have normal function of the lungs are no longer limited ventilation [1]. Many studies have shown the importance of exercise in patients before transplantation treatment.

Patients who had implemented exercise before transplantation have significantly better prognosis. [18] It is also recognized that the implementation of pulmonary rehabilitation directly affects the postoperative period in terms of better exercise capacity, muscle function and bone density [1].

### **Psychosocial aspects of pulmonary rehabilitation**

Lung transplantation leads to improved quantity of life but the recipient's quality of life often depends on many pre- and posttransplant factors. Pretransplant rehabilitation includes preparing patients for a lung transplant in psychological sense as well. It is not just a conversation or a psychological evaluation but a complex person-centered process, including fine techniques of guided individual and family counseling, psychoeducation, support and if necessary – psychotherapy. Lung transplant candidates appear to have lower quality of life than candidates for other types of transplantations [20,21] – probably because of higher illness burden. Anxiety and panic disorders are common in patients with lung disease, perhaps because of the shared mechanisms underlying dyspnea, hyperventilation, and symptoms and triggers of anxiety [22].

Beginning with the initiation of transplant evaluation, candidates experience a range of psychosocial challenges that require professional support in pretransplant period, perioperative recovery and long-term adjustment to life with a new organ. These psychosocial factors can either be the cause or the consequence of persons functional capacity, lost social roles and relationships, health behaviors, psychological status and overall adjustment [22].

Specific stressors during evaluation period for lung transplantation include uncertainty about eligibility for lung transplantation, fear of surgery in general, accepting potential changes in life plans, financial problems and conflicting feelings about treatment options [23,24].

In this phase, patients are often reluctant to reveal personal fears and/or psychological problems due to the fear that such information will jeopardize their chances of being accepted as a lung transplant candidate. It is crucial that the professionals working with patients understand this phenomenon and interpret it correctly. Patient's level of adjustment to the need for lung transplantation depends on the disease course, severity and health rate decline.

Interventions are made through pretransplant education, addressing ambiguities, conflicting emotions and moderating expectations. Optimism is desirable in this phase but can easily become unrealistic and cause difficulties in life adjustment after transplant. Expectations moderation during the whole transplantation period is

immensely important because it protects candidates and recipients from emotional „highs“ and „lows“ and focuses them on importance of pursuing necessary health behaviors.

After being listed as a candidate patients and their family experience the most stressful period of the transplantation experience. Balancing the notion that they may not survive the waiting period with the desire to make plans for the posttransplant life, causes anxiety to be present almost constantly [22]. Anxiety and tension are also the result of constant worry about when the phonecall will happen while at the same time experiencing monotony and frustration because of their function limitations caused by the progressed disease. This has an accumulating negative effect on quality of life. Interventions aimed at improving psychosocial outcomes among lung transplant candidates have showed favorable results. Interventions should be weekly, 8 to 12 sessions using cognitive-behavioral strategies to improve coping skills, quality of life, mood symptoms and relationships with family members or caregivers [22]. Stress reducing techniques such as relaxation trainings and/ or mindfulness based treatments are desirable.

Interventions are also made at enabling interactions with lung recipients that can give precise advise and support. These interactions are moderated when possible and recipients are educated on how to speak with a candidate.

During the perioperative recovery some recipients feel too optimistic and enthusiastic because of the rapid change in lung function so they can even feel „immune“ to any problems that might arise in that period. Others interpret the expected perioperative difficulties as a sign of overall decline in health and tend to be demoralised. Neither of these two reactions are desirable so during rehabilitation we are determined to predict and prepare candidates for these attitudes and educate the caregivers on how to approach them. Interventions are focused on education about the risk of posttransplant complications and the importance of self-monitoring [22].

Adjustment to lung transplant is complex and often needs support even after the first year has passed and majority of recipients has restored their quality of life to levels comparable to the ones before they became ill. Because majority of recipients have less functional impairments after transplantation, health related quality of life improves but new stressors arise. They have to adapt to ongoing medical issues and reliance on caregivers. Recipients have to find previously „lost“ family and social roles. They have to learn how to be „healthy“ again but responsible and alert. Keeping this balance is a challenge for the patient, family and the whole rehabilitation team.

Treating psychological problems, maintaining adherence to medical regimen, counseling, providing written materials, organizing support groups to help main-

tain good interpersonal connections with other recipients are all crucial parts of psychological support during pre- and posttransplantation rehabilitation.

## Conclusion

Further research is needed to understand the degree of benefits of pulmonary rehabilitation and to identify the effects of such structured rehabilitation on transplant patients compared to natural healing process. We see that not all transplant patients achieve the expected gains in muscle strength and exercise capacity after rehabilitation [1]. Reason for this is unclear and requires further researches with the renewal of pulmonary rehabilitation programs.

In the future, we see the need to increase the applicability and availability of pulmonary rehabilitation. This would lead to changes in daily behaviour of our patients, as well as optimize and maintain long-term positive effects of rehabilitation. The aim is to improve pulmonary rehabilitation and to adapt that to needs of each patient individually thus offering better health care and improve their life quality.

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#### Sažetak

### Uloga plućne rehabilitacije prije i nakon transplantacije

Plućna rehabilitacija ključna je komponenta u liječenju osoba s kroničnim bolestima dišnog sustava, a u programu transplantacije pluća igra važnu ulogu u smislu individualnog programa za svakog bolesnika prije i nakon transplantacije. Kod ovih je pacijenata nemogućnost vježbanja snažan predskazatelj ishoda operacije i preživljenja, stoga je baš ovo obilježje plućne rehabilitacije od iznimne važnosti. Intenzitet i režim vježbanja određen je karakteristikama bolesti od koje je pacijent bolovao prije transplantacije. Pretransplantacijska plućna rehabilitacija bolesnicima pomaže u optimiziranju i održavanju funkcionalnog statusa prije operacije uz pružanje interdisciplinarnih informacija važnih za predstojeću operaciju i oporavak. Također uključuje psihosocijalnu potporu za pacijenta i članove obitelji radi umanjivanja stresa i povećanja prilagodbe u periodu čekanja transplantacije. Posttransplantacijska rehabilitacija započinje u prvih 24-48 sati nakon operacije i usmjerena je na optimalno širenje pluća i toaletu dišnih putova, učinkovito disanje, aktivaciju ekstremiteta i hod. Edukacijska komponenta posttransplantacijske rehabilitacije uključuje poučavanje o željenom zdravstvenom ponašanju, rizicima, adekvatnom režimu uzimanja lijekova i zdravoj prehrani. Psihosocijalna potpora odnosi se na pomoć u ponovnom preuzimanju izgubljenih socijalnih i obiteljskih životnih uloga, savjetovanje, prilagodbu na novi organ i daljnje medicinske potrebe, dugoročno moderiranje očekivanja te brigu o psihičkoj dobrobiti pacijenta.

**Ključne riječi:** plućna rehabilitacija; transplantacija pluća; psihosocijalna potpora.

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