

Comprehensive pulmonary rehabilitation in patients with Bronchiolitis obliterans

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Introduction

Graft versus host disease (GVHD) is one of the most common complications after allogeneic hematopoietic stem cell transplantation (HSCT) and affects multiple organs. When GVHD affects the lungs, pulmonary dysfunction can be presented as bronchiolitis obliterans syndrome (BOS). BOS is a chronic irreversible airway obstruction disease and presents respiratory/skeletal muscle weakness. Although BOS patients are typically treated with immunosuppressive agents, there is no strong evidence that any specific therapies are effective in improving long-term outcomes. In these cases, we report the effect of pulmonary rehabilitation (PR) in patients with BOS. Case 1) A 42-year-old woman was referred to PR clinic with complaint of dyspnea on exertion. She was diagnosed with BOS after receiving allo-HSCT. When she visited PR clinic, her mMRC scale was 3. She was using a portable oxygen concentrator. Pulmonary function test (PFT) showed obstructive pattern with FVC 44%, FEV1 26% and FEV1/FVC 50.4%. In six minute walk test, she could walk 215m with oxygen supply of 3L. Cardiopulmonary exercise (CPX) test showed peak oxygen uptake (VO₂peak) was 15.7ml/kg/min, while she couldn't attain the target heart rate (HR). Aerobic exercise, breathing technique education, and respiratory muscle strengthening were included in PR programs. She exercised on treadmill for a total of 39 mins, three times a week for 12 wks at the hospital. Her aerobic exercise program consisted of a 5-min warm-up at 20-30% of heart rate reserve (HRR), followed by four times of 5-min intervals of walking on a treadmill at 50% of HRR with three active pauses of 3-min walking at 20-30% of HRR and a 5-min cooldown at 20-30% of HRR. After 12 wks of PR, her mMRC scale was changed from 3 to 2 and she did not use oxygen concentrator at daytime. Follow up PFT was improved in FVC. The distance of six minute walk test increased from 215m to 297m and follow up VO₂peak was 18.4ml/kg/min. Case 2) A 19-year-old man visited PR clinic with complaint of dyspnea and limitation of activity of daily life. He was diagnosed with BOS after receiving allo-HSCT. His mMRC scale was grade 2. PFT showed FVC 55%, FEV1 41% and FEV1/FVC 57.2%. The Results of six minute walk test was 450m, while his resting HR was 110 and maximum HR was 154. He underwent comprehensive PR program that consisted of 45 min of aerobic exercise and 15 min of respiratory muscle training. He received PR 2 times a week for 2 months at hospital. After 2 months of PR, his mMRC scale was 2. The follow up PFT improved in FVC. The distance of six minute walk test was increased from 450m to 534m. Furthermore, his resting HR decreased from 108 to 98.

Conclusion

Comprehensive PR can be effectively applied not only to COPD but also to various chronic lung diseases. In these cases, PR improved exercise capacity and dyspnea in BOS patients. More research is needed to confirm the effectiveness of PR and make the appropriate program for BOS patients.

Table 1. Changes of exercise capacity and pulmonary function before and after PR

Variables	Case 1	Case 2
VO_{2peak} (ml/kg/min)		
Baseline	15.7	26.4
After PR	18.4	Not tested
Change rate (%)	+ 17.20	
6 MWT (m)		
Baseline	215	450
After PR	297	534
Change rate (%)	+ 38.14	+ 18.67
mMRC		
Baseline	3	2
After PR	2	2
FVC (%)		
Baseline	44	55
After PR	71	71
Change rate (%p)	+ 27	+ 16
MIP (cmH₂O)		
Baseline	70	71
After PR	104	91
Change rate (%)	+ 48.57	+ 28.17
MEP (cmH₂O)		
Baseline	83	51
After PR	89	89
Change rate (%)	+ 7.23	+ 74.51
FEV₁ (%)		
Baseline	26	41
After PR	27	42
Change rate (%p)	+ 1	+ 1

6 MWT=six minute walking test, FVC=forced vital capacity, MIP=maximum inspiratory pressure,

MEP=maximum expiratory pressure, FEV₁=forced expiratory volume in 1 second