

Effect of pulmonary rehabilitation on pulmonary function in a stroke patient with COPD: Case report

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Introduction

stroke patients show an exercise capacity that is reduced by about 40% when compared with the control group of the same age and sex, and it may be more severe in the case of underlying pulmonary disease. We report a case of a stroke patient with chronic obstructive pulmonary disease (COPD) who underwent 3 weeks of pulmonary rehabilitation (PR) along with conventional stroke rehabilitation program.

Case

A 71-year-old man with COPD visited the emergency room due to dysarthria and aphasia without motor and sensory change. Brain MRI showed infarction of left middle cerebral artery territory, and he was admitted to the Department of Neurology. He was transferred to the Department of Rehabilitation for rehabilitation treatment focused on aphasia. His baseline characteristics including Modified Medical Research Council scale (mMRC), pulmonary function test (PFT), hand grip power, Korean Modified Barthel Index (K-MBI), and Berg balance scale are shown in Table 1. He also underwent surface electromyography (sEMG) in upper trapezius, sternocleidomastoid, external oblique, and diaphragm muscles. (Figure 1) To measure the activity of the respiratory muscles, muscle activation intensity (%) was calculated: $[\text{mean root mean square (RMS) of each muscle} / \text{mean RMS of the maximal voluntary contraction}] \times 100$. Since he has COPD, he underwent 3 weeks of PR along with conventional stroke rehabilitation program. The PR program consisted of 60 minutes of aerobic exercise, respiratory muscle strengthening, and stretching exercise. Aerobic exercise is carried out using an ergometer and treadmill. Respiratory muscle strengthening was performed using threshold inspiratory muscle training (IMT) and threshold positive expiratory pressure (PEP) devices. After 3 weeks of the rehabilitation, follow up examinations were performed, and showed mild improvements in forced expiratory volume in one second (FEV1), FEV1/forced vital capacity (FVC), values in sEMG, hand grip power, and K-MBI (Table 1).

Discussion

After 3 weeks of PR, the Results of FEV1 and FEV1/FVC were improved, which suggests an improvement of airway obstruction in a patient with obstructive lung disease. Furthermore, the Results of sEMG showed that PR could increase the use of the primary respiratory muscles (diaphragm, external oblique muscle), and reduce the use of accessory respiratory muscles (upper trapezius muscle, sternocleidomastoid muscle) during breathing. In addition, there was an improvement in hand grip power and K-MBI, but it was considered to be more related to the effect of conventional rehabilitation than that of PR.

Conclusion

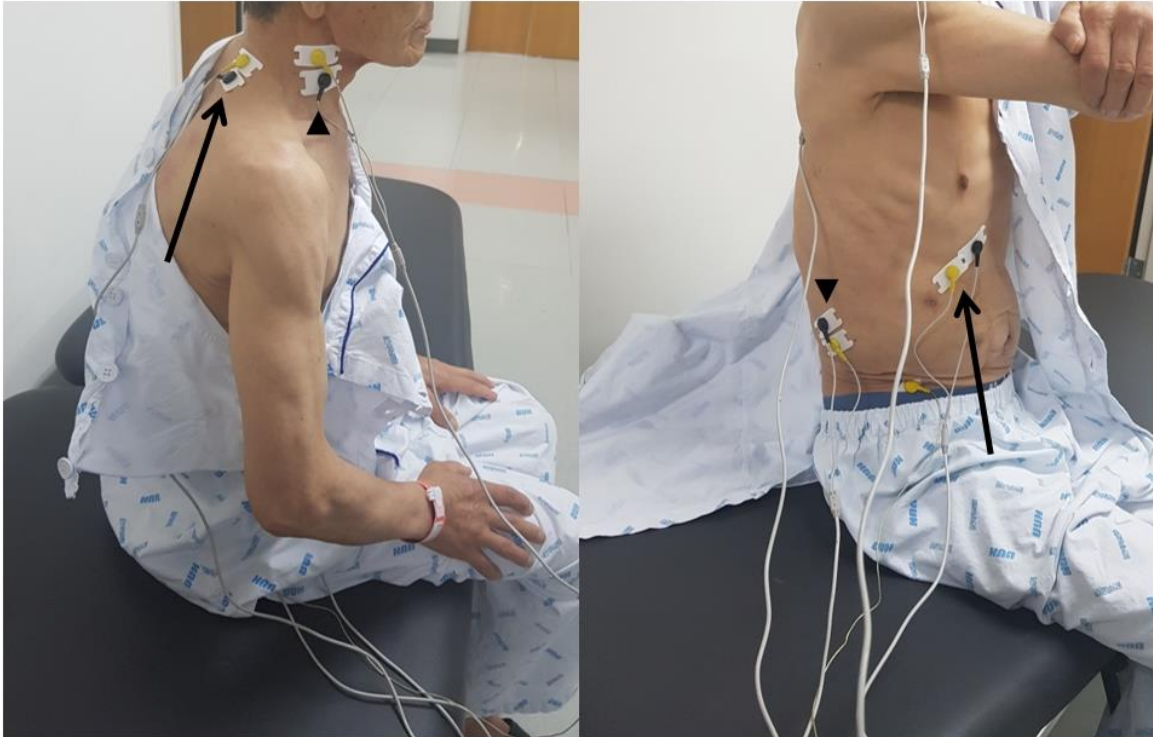
This case shows the effect of 3 weeks of PR on pulmonary function in a stroke patient with COPD. To generalize the Result, further evaluation is required in larger, prospective studies.

Table 1. Comparison of outcome measurements before and after 3 weeks of pulmonary rehabilitation in a stroke patient with chronic obstructive pulmonary disease

		Pre-treatment		Post treatment	
mMRC		3		3	
Pulmonary function test		Pre-bronchodilator	Post-bronchodilator	Pre-bronchodilator	Post-bronchodilator
	FVC (Liters)	2.90 (82)	3.02 (86)	2.89 (82)	2.91 (83)
	FEV1 (Liters)	1.64 (65)	1.85 (73)	1.76 (70)	1.81 (72)
	FEV1/FVC (%)	57	61	61	62
	PI max (cmH2O)	53 (51)		54 (52)	
	PE max (cmH2O)	84 (43)		69 (35)	
Muscle activation intensity (%) in sEMG	Upper TPZ	41		43	
	SCM	63		21	
	EO	41		66	
	Diaphragm	28		85	
Hand grip power (kg)	Right	12.7		14.3	
	Left	12		14.7	
K-MBI		80		90	
BBS		53		53	

Values are presented as number (% when needed).

mMRC: Modified Medical Research Council scale; FEV1: forced expiratory volume in one second; FVC: forced vital capacity; PI max: maximal inspiratory pressure; PE max: maximal expiratory pressure; sEMG; surface electromyography; SCM: Sternocleidomastoid muscle; EO: External oblique muscle; K-MBI: Korean Modified Barthel Index; BBS: Berg balance scale



- (a) Right upper trapezius muscle (arrow)
- (b) Right sternocleidomastoid muscle (arrow head)

- (c) Right diaphragm muscle (arrow)
- (d) Right external oblique muscle (arrow head)

Figure 1. The locations of electrodes in surface electromyography of respiratory muscles