

## Effect of pulmonary rehabilitation program on patients admitted to ICU: a comparative cross sectional study

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### ABSTRACT

Generally ICU patients are in critical status and need long stay in ICU. Pulmonary rehabilitation program (PRP) is considered as an important tool to improve outcome and shorten the length of stay in ICU. The aim of this study was to investigate whether PRP can affect outcome and duration of hospitalization in ICU patients. This study was performed in medical ICU of Labafi Nejad hospital, Tehran, Iran during 2012 and 2013. All of patients who had more than one day stay in ICU were included in the study. They underwent PRP. We compared length of stay, mortality rate and number of hospitalized patients within 2 years in patients with PRP and patients without PRP. In 2012, 155 patients and in 2013, 173 patients were admitted in ICU. Admission period was  $15 \pm 2.7$  and  $11 \pm 2.1$  days, respectively ( $p < 0.001$ ). Pulmonary physiotherapy showed no effect on patients' outcome in which during 2012, 94 patients were discharged and 61 patients were died and in 2013, 98 patients were discharged and 64 patients were died ( $p=0.9$ ). Our study shows that PRP can shorten hospitalization time which can indirectly decrease hospitalization costs but there is no effect on overall survival.

**Key words:** Pulmonary rehabilitation; Outcome; Critical patients; ICU.

### INTRODUCTION

There is a general agreement that rehabilitation is reserved to a multidisciplinary interventions in which management of each patient should be individualized [1].

World wide population is aging and critical illness conditions increase with aging. Thus, there is a possibility to have a large increase in number of patients surviving an episode of critical care in the upcoming years [2]. Skeletal muscle strength and endurance performances are impaired not only as a consequence of bed rest but also because of a direct effect of hypercapnia, hypoxia, malnutrition, treatment with corticosteroids or other agents, and homodynamic instability [3].

A simple and low-cost pulmonary rehabilitation program can shorten length of stay in ICU but has no effect on outcome of disease. Early physical therapy may prevent difficult weaning, limited mobility and ventilator dependency. Prolonged hospital stay

and lack of response to therapies can often cause severe complications such as muscle weakness, physical deconditioning, recurrent symptoms, mood alterations and poor quality of life [4,5]. Due to the increasing number of ICU admissions and the global risk of complications and mortality over the following years, comprehensive programs including physiotherapy should be implemented to speed-up the patients' functional recovery and to prevent the complications of prolonged immobilization especially in ventilator-dependent or difficult- to wean patients [6,7]. The Pulmonary Rehabilitation Program (PRP) is used to decrease complications and patient's ventilator dependency, therefore it decrease rate of complications that are associated with bed-rest. In addition, PRP improves residual functions, health status and quality of life [8]. The present study was designed to investigate whether PRP can affect outcome and duration of hospitalization in ICU patients.

## PATIENTS AND METHODS

This cross sectional study was done in Labafi Nejad hospital, Tehran, Iran. Between January 2012 and April 2013 a consecutive of 328 patients were enrolled. All of patients who had more than one day stay in ICU were included in the study. In 2012 pulmonary rehabilitation program was performed by attending physician request in selected patients but in 2013 this program was performed in all ICU admitted patients. Patients were divided into two groups: patients with PRP and patients without PRP. Ethics Committee of Shahid Beheshti University of Medical Sciences approved the study.

### **Pulmonary rehabilitation program (PRP)**

Pulmonary rehabilitation program (PRP) was performed for all patients upon the patients conditions in 2013 and in selected patients in 2012. Physiotherapy techniques in the ICU containing Mobilization (Postures, active and passive limb exercise), Muscle training (respiratory and peripheral muscle training), airway Secretions Management (manual hyperinflation or percussion and vibrations). The comprehensive rehabilitation program

consisted of two daily sessions of 30 to 45 minutes according the patients need and tolerance.

### **Statistical analysis**

Data were presented as means  $\pm$  SD. Statistical analyses were performed with SPSS software for Windows (Statistical Product and Service Solutions, version 17.0, SSPS Inc, Chicago, IL, USA). Comparisons between groups were made using *t*-test for continuous variables. P values less than 0.05 were considered statistically significant.

## RESULTS

Patients' characteristics are shown in Table 1. Mean age of patients was  $64.8 \pm 14.9$  years old (range 56–77). Duration of hospitalization was significantly less in patients admitted in 2013(  $15 \pm 2.7$  days ) and 2012 (  $11 \pm 2.1$  days ) ( $p < 0.001$ ). In our study pulmonary physiotherapy showed no effect on patients' outcome.

As showed in Table 2, during 2012, 60.6% of patients ( 94/155 ) were discharged and 61 patients (39.4%) were died while among patients admitted in ICU in 2013, 98 patients (60.5%) were discharged and 64 patients (39.5%) were died ( $p=0.9$ ).

**Table 1.** Patients' characteristics

Parameter	Patients without PRP (N=155)	Patients with PRP (N=173)	P value
Age	$71.3 \pm 6.5$	$72.1 \pm 4$	0.2
Sex			0.4
Male	83 (53.5)	97 (56)	
Female	72 (46.5)	76 (44)	
BMI ( $\text{kg}/\text{m}^2$ )	$33.24 \pm 5.51$	$36.91 \pm 7.67$	0.36
Underlying disease			0.36
CRF	34 (21.9)	45 (26)	
Sepsis	53 (34.2)	72 (41.6)	
COPD / Asthma	68 (44.9)	56 (32.4)	
SpO <sub>2</sub> (%)	$92.28 \pm 1.72$	$94.30 \pm 1.52$	0.32
Blood pressure (mmHg) (systolic)	$143.7 \pm 12.6$	$13.8 \pm 10.9$	0.42
Heart rate (Beats/min)	$77.35 \pm 9.74$	$84.31 \pm 7.01$	0.18
Hospitalization Duration (days)	$15 \pm 2.7$	$11 \pm 2.1$	<0.001

Data are shown as number and (percentage). CRF: chronic respiratory failure; COPD: chronic obstructive pulmonary disease; BMI: body mass index

**Table 2.** Effect of PRP on discharge and death

	Patients without PRP (N=155)	Patients with PRP (N=173)	P value
Discharge	94 (60.6)	98 (56.6)	0.95
Expire	61 (39.4)	75 (43.3)	

Data are shown as number and (percentage).

## DISCUSSION

Pulmonary rehabilitation program (PRP) is known as a complex of scientific procedures to improve status of patients suffering from chronic respiratory disease. In this study we evaluated the advantages of PRP in ICU patients. Our results showed that PRP could decrease the length of stay in ICU but failed to improve the mortality rate. Cumulative evidence suggests advantages of PRP on patients' pulmonary function and improvement of treatment outcome. There are various studies showing the benefits of PRP on improvement of pulmonary function in different pulmonary disorders such as ICU admitted patients, chronic pulmonary disorders and chronic obstructive pulmonary disease [9,10]. These studies have shown that PRP can reduce prescription time, lessen over-prescription of respiratory treatments, decrease treatment and hospitalization costs and improve quality of life [11-15]. It has been shown that although PRP may vary due to environmental and patients' status but can improve pulmonary function in chronic respiratory diseases in any lung disease stage, specially in severe ones [16]. It has also been suggested that the earlier the PRP is began the better the outcome and treatment effect [17]. It has been demonstrated that any delay in beginning rehabilitation program will increase the costs of patients stay in hospital. There are some explanations for benefits of PRP. Immobility is an inevitable consequence of ICU admission and it is shown that immobility has various adverse effect of body function including cardiovascular system, bone and skeletal muscles. The capacity of cardiac function and muscle contraction decrease while immobilization, bone density decreases, bone mineralization shows impairment. Cardiovascular system loses its ability to maintain blood pressure while position changes. Muscle bulk also decreases, not only because of immobilization but also due to hypercapnia and hypoxia [9].

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Early mobilization is one the main goals of PRP which can avoid the mentioned side effect to take place. Additionally, overuse of mechanical ventilation can cause some complications such as diaphragm muscle atrophy which itself can lead to weaning failure in ventilated patients [18]. Various therapeutic methods are introduced to treat muscle weakness and immobilization side effects including passive and active limb movement, respiratory and peripheral muscle training neuronal electric stimulation [19,20]. A study showed that PRP can increase quality of life in patients with heart failure and pulmonary obstructive disease [21]. Moreover, Brummel study demonstrated that PRP could reduce disabilities in patients with critical conditions [22]. As mentioned, our results showed decreased hospitalized time in patients treated by PRP but no decrease in mortality rate was observed.

The basic goals of pulmonary rehabilitation are to maintain the residual pulmonary function, decrease patient dependency to ventilator, and subsequently decrease in patient stay in hospital and finally to improve patient quality of life after discharge but mortality rate reduction is not mentioned as primary goals of PRP. As a limitation we have not evaluated the costs of hospitalization in both patients groups to compare the hospitalization costs in them.

## CONCLUSION

In summary PRP can decrease hospitalization period which can indirectly decrease hospitalization costs and may improve patients' quality of life but further studies are recommended to explore PRP effect on mortality rate especially in more categorized and selective patient groups.

## ACKNOWLEDGMENT

The authors wish to thank the staff of Labaffi Nejad hospital for their helps.

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