The Use of an Algorithm to Facilitate Early Mobilization of Mechanically Ventilated Patients

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Purpose/Hypothesis: The goal of this investigation was to study the impact of using an algorithm to guide early mobilization of mechanically ventilated patients in ICU and assess its effectiveness.

Number of Subjects: The investigation enrolled 78 ICU patients with different diagnosis. A study group was comprised of 41 patients who received early rehabilitation program in ICU; the control group included 37 patients who had standard ICU therapy.

Materials/Methods: The patient selection criteria were patients in ICU for more than 7 days and on mechanical ventilation for more than 3 days. Steps of mobilization were defined by degree of mobility and Rivermead index (RMI) as follows: 1. RMI = 0-1, a) Changing the position of a patient every 2 hours. b) Moving up the head end of tilt table sequentially to 30-45-60 degrees; c) Passive exercises for upper and lower limbs; d) Proprioceptive stimulation of feet by CORVIT simulator device; e) Cylindrical ergometry with simulator (upper and lower limbs, from 15 to 60 minutes 2 times a day). 2. RMI = 2 and no orthostatic reactions; a) Same as for RMI = 0-1, b) Moving up the tilt table sequentially to 60-75 degrees while holding on at each level. c) Sitting on the side of bed. d) Sitting in a chair (assistance of 2 staff). 3. RMI = 3a) Active and passive exercises for upper and lower limbs 10 to 50 times; b) Cylindrical ergometry simulator for arms and legs 2 times a day; c) Sitting in a chair for 30-40 minutes 2 times/day; d) Exercises for fine motor skills recovery; e) Staying at parapodium (two assistant needed) after sitting in a chair. Each steps of mobilization included measuring the blood pressure, percutaneous oxygen saturation and clinical status immediately after verticalization, then after 2.5 and 5 minutes and then after each 2.5 minutes during 15 minutes in the first days of sitting. If hemodynamics remains stable in the following days, the measurement took place every 5 minutes when sitting.

Results: There were significant differences between the study and control groups with statistically significant difference level of (p = 0.05): - average ventilator days: a decrease from 26 days in the control group and 20 days in the study group (p = 0.025); - in the incidence of nosocomial pneumonia: a decrease in cases from 92% in the control group to 83% in the study group (p = 0.007); - in the changing increase of muscle strength at hospital discharge from 1.8 to 2 scores in the control group and from 2.5 to 3 scores in the study group (p = 0.037); - in the
Rivermead mobility index: an increase from 1.3 in the control group to 2.45 in the study group (p = 0.021).

**Conclusions:** Early mobilization of mechanically ventilated patients using an algorithm increases the effectiveness of ICU treatment by reducing ventilator days, decreasing the number ventilator-associated pneumonia and by improving functional status of patients.

**Clinical Relevance:** The use of an algorithm can facilitate early mobilization of mechanically ventilated patients in ICU increases their functional status.