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Effect of Early vs Late Mobilization on the Length of ICU Stay among Critically Ill Patients

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ABSTRACT

Background: Intensive care unit (ICU) acquired weakness is characterized by fatigue and profound neuromuscular weakness. Early Mobilization is an effective intervention in improving ICU acquired weakness and reducing length of ICU and hospital stay.
Objectives: To assess the effect of the early vs late mobilization on the length of ICU stay among critically ill patients in a view to formulate mobility protocol in critically ill patients.
Methods: A pre-experimental design was used for the study. 30 critically ill patients were selected by using purposive sampling technique and then allocation of subjects was done into experimental group1 (n1=15) and experimental group2 (n2=15). In experimental group1, early mobilization was done within the 5 days of admission in ICU. In experimental group2, late mobilization was done after the 5th day of admission in ICU. Data was collected by using patients' profile and tool related to ICU stay with the help of interview method, observation, records and reports and bio-physiological measures and was analyzed with the use of descriptive and inferential statistics.
Results: Statistically significant results were found between experimental group1 and experimental group2 in patient's total no. of ICU days till discharge (p= 0.000), total no. of ICU days post enrolment till discharge (p=0.011), first day when out of bed (p= 0.000) and first day of weaning from ventilator (p=0.000).
Conclusion: Early mobilization is effective in reducing the length of ICU stay in critically ill patients.

***Keywords*:** Early mobilization, late mobilization, critically ill patients, length of ICU stay

INTRODUCTION

In most of the intensive care units ICUs, bed rest is considered as the routine standard of care which leads to immobility, deconditioning and weakness.[1]

Immobilization is usually a part of treatment, due to pharmacologically induced sedation and/or mechanical ventilation (MV).[2] Critically ill patients often regularly required lengthy mechanical ventilation.[3] Patients who are admitted in ICUs are surrounded by various equipment and life support systems, and therefore mobilization is considered to be a complex task.[4] Early mobilization is an important component of physiotherapy used to prevent and decrease immobilization complications.

Immobilization is harmful in critically ill patients.[5] Intensive care unit (ICU) acquired weakness is characterized by fatigue and profound neuromuscular weakness that can cause serious functional disability in survivors. ICU-acquired

weakness is known to be associated with increased duration of mechanical ventilation, immobilization, and increased ICU and hospital length of stay (LOS). A widely accepted definition of early mobilization is that the application of physical activity within the first 2 to 5 days of the critical illness or injury. Early mobilization has been shown to improve many other parameters including functional status at discharge, ICU, and hospital length of stay (LOS). In critically ill patients there's a really rapid loss of muscle mass which is due to stress-related malnutrition. Early mobility prevents this loss of lean body mass resulting in decrease the length of ICU stay and early discharge from ICU.6 Immobilization can lead to rapid deconditioning and muscle atrophy.7 Immobilization in the ICU may be an important risk factor for long term muscle weakness.[8]

ICU-acquired weakness is defined as the presence of clinical detectable weakness in ICU patients with no possible etiology other than critical illness.9 Such weakness of the extremities as occurs with ICU-acquired weakness is also associated with respiratory muscle weakness and prolonged weaning from mechanical ventilation. The intensive care unit acquired weakness (ICUAW) is associated with joint contractures, thromboembolism, resistance to insulin, micro vascular alterations, pressure ulcers, pneumonia, extension of the weaning period, delirium, increase in the days of income, increased mortality, and development of disabilities.[10]

Early mobilization is considered therapeutic strategies to prevent the development of intensive care unit acquired weakness. Patient safety is one of the most commonly reported barriers to delivering early mobilization, including respiratory, cardiovascular, and neurological stability and the integrity of invasive lines.[11]

Early mobilization in ICUs may help to improve the respiratory function by optimizing the ventilation/perfusion matching, increase the lung volume and improve the airway clearance, reduce the adverse effects of immobility, increase the level of consciousness, improve cardiovascular fitness, increase functional independence, and increase psychological well-being.[12] Early mobilization of critically ill patients may improve the physical functioning and decrease duration of mechanical ventilator and non-invasive ventilator, oxygen therapy and length of stay in ICU. It improves outcome of mechanical ventilated patient and decreased mechanical ventilation associate weakness. The benefits of early mobilization include reduction in length of stay in ICU and hospital as well as improvements in strength and functional status.[13]

A study was done by Leong YL, Rasnah AR, Chong MC (2017), on Patient Early Mobilization: A Malaysia's Study of Nursing Practices, stated that the practices of early mobilization on mechanical ventilated patient is associated to decrease length of stay in intensive care unit, decrease ventilator associated pneumonia, prevent deep vein thrombosis and skin breakdown.[14]

The mechanically ventilated patients often develop muscle weakness post intensive care admission. The current evidence suggests that early mobilization of these patients can be an effective intervention in improving their outcomes.[15] Early mobilization is one of the possible preventive maneuvers to reduce length of ICU stay and improving ICU acquired weakness.[14] Numerous studies have suggested that exercise could improve ICU acquired weakness and reduces the length of ICU stay.

MATERIALS AND METHODS

A pre-experimental design was used to assess the effect of early vs late mobilization on the length of ICU stay among critically ill patients admitted in ICUs of DMCH, Ludhiana (Punjab) using purposive sampling. A written permission was taken from Institutional Ethics Committee of DMCH, Ludhiana. Consented

patients who were above 18 years of age, on mechanical ventilator support or on non-invasive ventilator support more than 48hours, out of sedation, able to understand Hindi/Punjabi/English and willing to participate in the study were enrolled in the study. The exclusion criteria include those who were having: any neurological impairments, unstable fractures, spinal injuries, fracture of lower limbs, postoperative status and un-cooperative behavior. As per the inclusion and exclusion criteria, 30 critically ill patients admitted in intensive care units of DMCH Ludhiana, Punjab were drawn from the target population by using purposive sampling technique and then allocation of subjects were done into experimental group$_1$ (n_1=15) and experimental group$_2$ (n_2=15) In experimental group1, early mobilization was done and in experimental group2, late mobilization was done as per mobility protocol. **(Figure 3)**

Early mobilization in experimental group$_1$: It refers to the mobilization of critically ill patients within the 5days of admission in ICU for 30-60 mint twice/day till discharge from ICU and

Late mobilization in experimental group$_2$: It refers to the mobilization of critically ill patients after the 5th day of admission in ICU for 30-60 mint twice/day till discharge from ICU.

Post-intervention, data was collected from experimental group$_1$ and experimental group$_2$related to ICU stay by using the research tool including:

PART A: **Patient's profile** which is further divided into two sections:

Section I **-Socio demographic profile:** It includes 9 items to obtain information about age in years, gender, educational status, religion, habitat, marital status, occupation, dietary habits and socio-economic status.

Section II**- Clinical profile:** It includes 6 items to obtain information about diagnosis, BMI, days in hospital on the day of enrolment, type of ventilator support, no. of days patient is on ventilator prior to mobilization and on physiotherapy.

Part B: Tool related to ICU stay: It was self-structured tool which was further divided into 10 items i.e. Total no. of ICU days till discharge, Total no. of ICU days post enrolment till discharge, Patient's first day when out of bed, First day of the weaning from ventilator, Mode of Ventilator, conscious level (FOUR score scale), Assessment of muscle strength with the MRC-Scale, Reasons of leaving ICU, Problem faced during weaning, Reasons of leaving ICU and Vital Signs.

Methods used for data collection were interview, observation, records & reports and biophysiological measures. Data was analyzed with the use of descriptive and inferential statistics. Comparison was done between both experimental group$_1$ and experimental group$_2$ related to their ICU stay.

RESULTS

As per socio demographic profile of critically ill patients both groups were found to be homogenous ($p>0.05$) as per their age, gender, habitat, and religion, marital status, dietary habits, occupation and socio economic status whereas the two groups i.e. experimental group1 and experimental group2 were found to be heterogenous ($p<0.05$) as per their education status. Mean age of experimental group1 was 50.07 ±10.859 and in experimental group2 was 51.93±15.09 and majority was males. **(Table 1)**

As per clinical profile of critically ill patients both the groups were found to be homogenous ($p>0.05$) in diagnosis, BMI, type of ventilator support on enrolment and on physiotherapy and both groups were found to be heterogenous ($p<0.05$) in days in hospital and no. of days patient is on ventilator prior to enrolment. Mean BMI of experimental group1 was 24.8+8.1 and in experimental group2 was 23.7±6.31, Mean days in hospital on the day of enrolment in experimental group1 was 3.6+0.97 and in

experimental group2 was 9.4±2.39 and Mean no. of days patient is on ventilator prior to enrolment in experimental group1 was 3.2+1.04 and in experimental group2 was 9.2±2.17. **(Figure 1 and Table 2)**

Table 1: Frequency and percentage distribution of critically ill patients among experimental group1 and experimental group2 as per theirsocio-demographic profile N= 30

Socio-demographic profile	Experimental group1 n1=15 f(%)	Experimental group2 n2=15 f(%)	Total N=30	χ^2 Statistics
Age (in years)				
18-38 39-58 59-78 79-above	3(20.0) 8(53.3) 4(26.7) 0(0.0)	2(13.3) 9(60.0) 3(20.0) 1(6.7)	5 17 7 1	1.402 df=3 p= 1.402 ^{NS}
Gender				
Male Female	12(80.0) 3(20.0)	9(60.0) 6(40.0)	21 9	1.429 df= 1 p=0.232^{NS}
Habitat				
Rural Urban	12(80.0) 3(20.0)	7(46.7) 8(53.3)	19 11	3.589 df= 1 p=0.058^{NS}
Educational status				
Illiterate Elementary Secondary Graduate and above	1(6.7) 3(20.0) 9(60.0) 2(13.3)	0(0.0) 8(53.3) 2(13.3) 5(33.3)	1 11 11 7	9.013 df= 3 p= 0.029*
Religion				
Hindu Sikh	4(26.7) 11(73.3)	5(33.3) 10(66.7)	9 21	0.159 df= 1 p=0.690^{NS}
Marital status				
Married Unmarried/Single Widow/Widower	13(86.7) 2(13.3) 0(0.0)	13(86.7) 1(6.7) 1(6.7)	26 3 1	1.333 df= 2 p=0.513^{NS}
Dietary habit				
Vegetarian Non-vegetarian Lacto ova vegetarian	5(33.3) 5(33.3) 5(33.3)	7(46.7) 6(40.0) 2(13.3)	12 11 7	1.710 df= 2 p= 0425^{NS}
Occupation				
Working Non-working	11(73.3) 4(26.7)	9(60.0) 6(40.0)	20 10	0.600 df= 1 p=0.439^{NS}
Socioeconomic status				
Upper (I) Uppermiddle(II) Lower middle (III) Upper lower(IV)	2(13.3) 6(40.0) 6(40.0) 1(6.7)	3(20.0) 3(20.0) 8(53.3) 1(6.7)	5 9 14 2	1.486 df= 3 p= 0686^{NS}

Mean age±SD in Experimental gp1=50.07 ±10.859,
Mean age±SD in* Experimental *gp2= 51.93±15.09

****Significant***
NS= Non-Significant

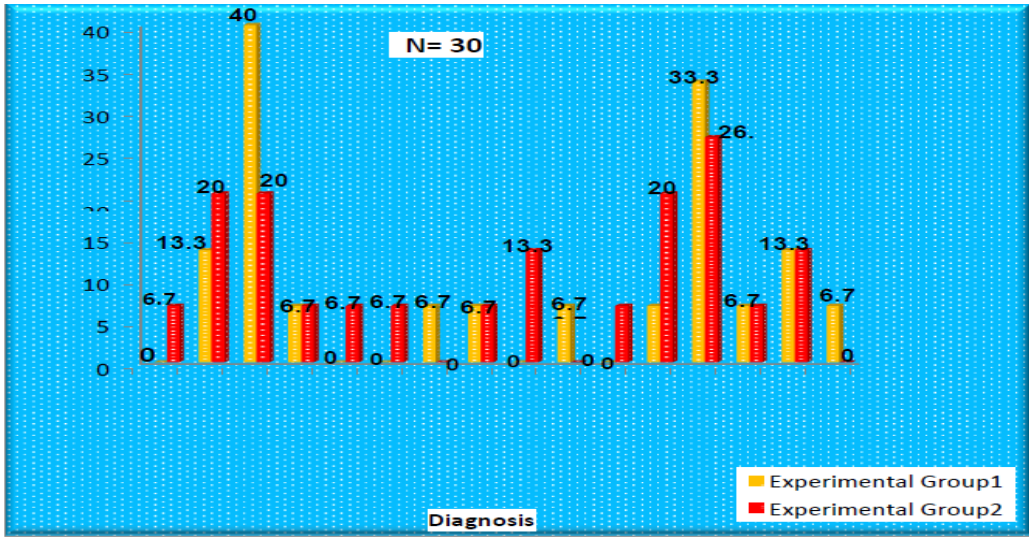

Fig1: Distribution of Critically ill patients according to their diagnosis

Table 2: Frequency and percentage distribution of critically ill patients among experimental group1 and experimental group2 as per theirclinical profile N= 30

Clinical profile	Experimental group1 n1=15 f(%)	Experimental group2 n2=15 f(%)	Total N=30	□2 Statistics
BMI (Categories)				
<18.5 (Underweight)	0(0.0)	0(0.0)	0	2.727 df= 2 p= 0.256^{NS}
18.5-24.9 (Normal)	9(60.0)	13(86.7)	22	
25.0-29.9 (Overweight)	3(20.0)	1(6.7)	4	
>30.0 (Obese)	3(20.0)	1(6.7)	4	
Days in Hospital on the day of enrolment				
1-3	7(46.7)	0(0.0)	7	23.600 df= 3 p=<0.001*
4-6	8(53.3)	2(13.3)	10	
7-10	0(0.0)	6(40.0)	6	
Above 10 days	0(0.0)	7(46.7)	7	
Type of ventilator support on enrolment				
Mechanical Ventilator	10(66.7)	10(66.7)	20	<0.001 df= 1 p= 1.000^{NS}
Non-invasive ventilator	5(33.3)	5(33.3)	10	
No. of days patient is on ventilator prior to enrolment				
1-3	11(73.3)	0(0.0)	11	24.667 df= 3 p=<0.001*
4-6	4(26.7)	2(13.3)	6	
7-10	0(0.0)	6(40.0)	6	
Above 10 days	0(0.0)	7(46.7)	7	
On Physiotherapy				
Yes	14(93.3)	14(93.3)	28	<0.001
No	1(6.7)	1(6.7)	2	df= 1 1.000^{NS}

Mean BMI ±SDin exp. gp1= 24.8±8.1, exp. gp2= 23.7±6.31*Significant
Mean Days in Hospital on the day of enrolment ±SDin exp. gp1= 3.6±0.97, in exp. gp2= 9.4±2.39 NS= Non-Significant
Mean No. of days patient is on ventilator prior to enrolment ±SD in exp. gp1= 3.2±1.04, in exp. gp2= 9.2±2.17

The total no. of ICU days till discharge, in experimental group$_1$ mean±SD was 6.87±1.457 and in experimental group$_2$mean±SD was 15±4.259. Hence, statistically significant results were found in total no. of ICU days till discharge between experimental group$_1$ and experimental group$_2$ (p= 0.000).

The total no. of ICU days post enrolment till discharge, in experimental group$_1$ mean±SD was 4.27±1.163 and in experimental group$_2$mean±SD was 6.20±2.513. Hence, statistically significant results were found in total no. of ICU days post enrolment till discharge between experimental group$_1$ and experimental group$_2$ (p= 0.011).

The patient's first day when out of bed, in experimental group$_1$ mean±SD was 3.13±0.99 and in experimental group$_2$ mean±SD was 8.93±2.219. Hence, statistically significant results were found in patient's first day when out of bed between experimental group$_1$ and experimental group$_2$ (p= 0.000).

The first day of the weaning from ventilator, in experimental group$_1$ mean±SD was 1.53±0.516 and in experimental group$_2$mean±SD was 3.33±0.617. Hence, statistically significant results were found in first day of the weaning from ventilator between experimental group$_1$ and experimental group$_2$ (p= 0.000). **(Table 3 and Figure 2)**

Table 3: Comparison of critically ill patients among experimental group1 and experimental group2 as per their ICU stay N= 30

ICU stay	Mean ± SD		Mean Difference	Unpaired T test
	Experimental group1	Experimental group2		
Total no. of ICU days till discharge	6.87+1.457	15+4.259	8.13	6.997 p= 0.000*
4 Total no. of ICU days post Enrolment till Discharge	4.27+1.163	6.20+2.513	1.93	2.704 p= 0.011*
Patient's first day when out of bed	3.13+0.99	8.93+2.219	5.80	9.244 p= 0.000*
First day of the weaning from ventilator	1.53+0.516	3.33+0.617	1.80	8.663 p= 0.000*

****Significant***

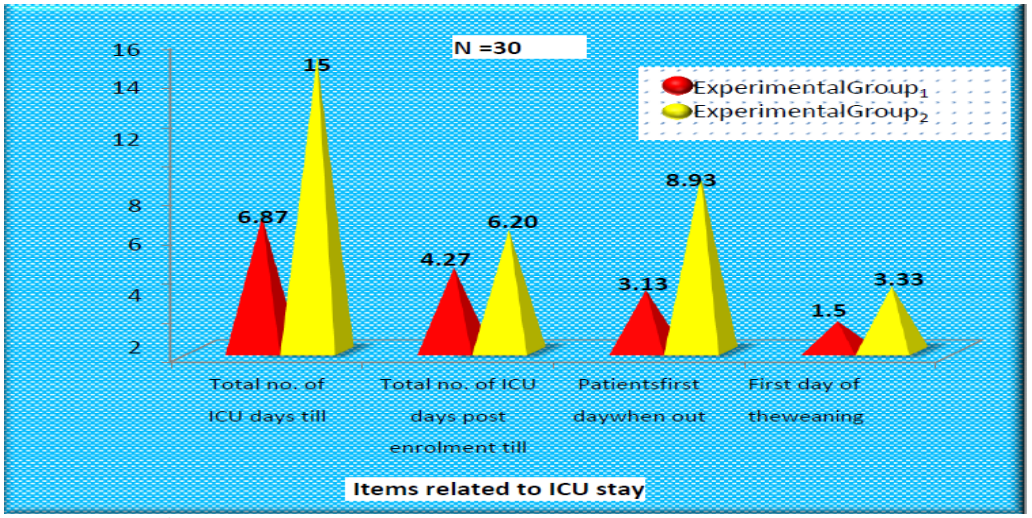

Fig2: Comparison of critically ill patients among experimental group1 and experimental group2 as per their ICU stay

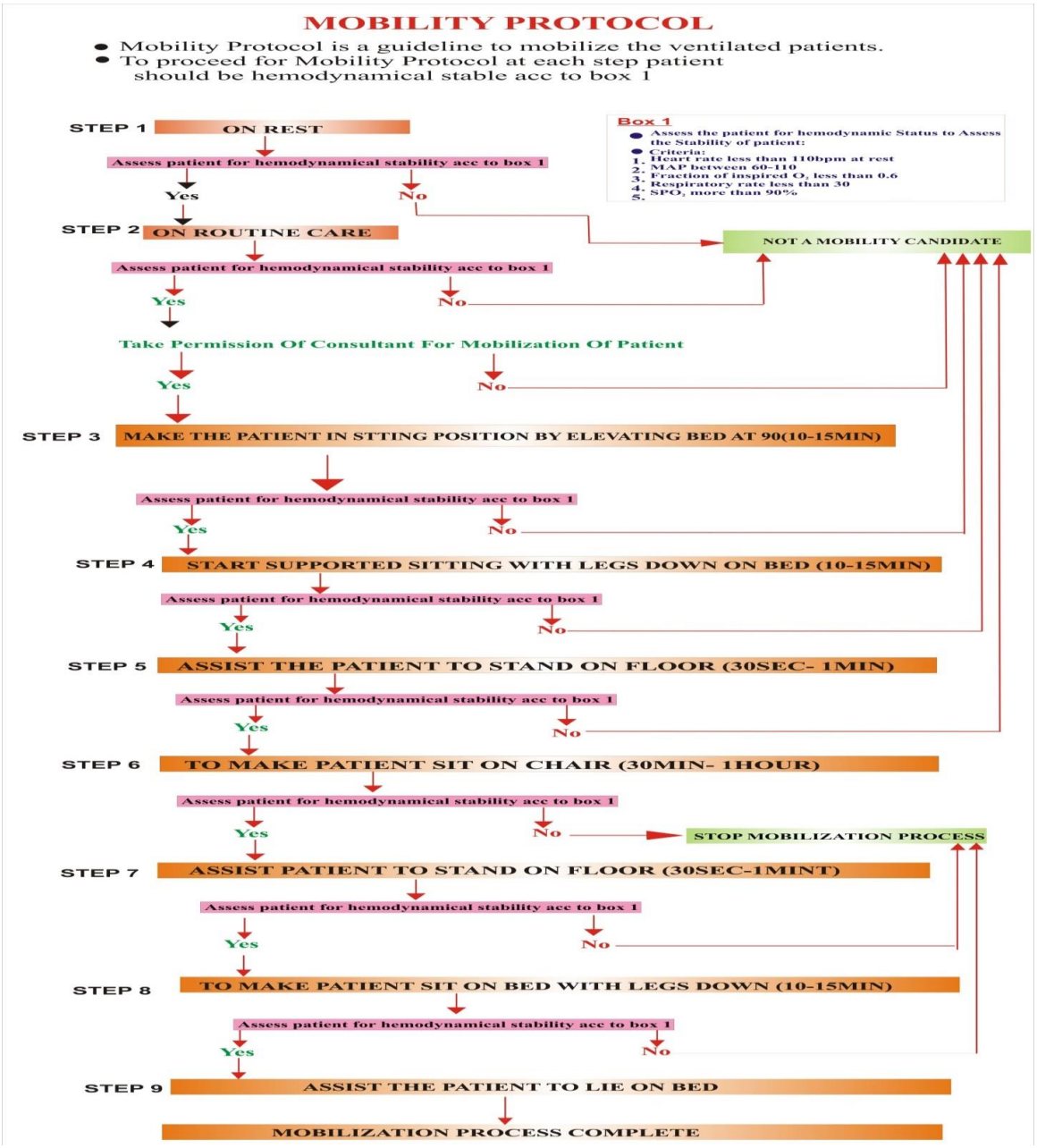

Fig3: Mobility Protocol

For mode of ventilator: a significant effect was seen on the day of enrolment and on the day of discharge from ICU within the experimental group1 i.e. (p=0.002) and in experimental group2 (p=0.001). For conscious level (FOUR score scale): a significant effect was seen on the day of enrolment and on the day of discharge from ICU within the experimental group1 i.e. (p=0.022) and in experimental group2 (p=0.000). For the vital signs (respiratory rate): a significant effect was seen on the day of enrolment and on the day of discharge from ICU within experimental group1 (p=0.0377) and in experimental group2 (p=0.001). For vital signs (SpO2): a significant effect was seen on the day of enrolment and on the day of discharge from ICU within experimental group2 (p=0.0013).

DISCUSSION

Prolonged bed rest or immobilization among critically ill patients is potentially harmful with complications of pulmonary edema, atelectasis, bone demineralization, muscle wasting, vasomotor instability, constipation, back pain, pressure ulcers, contractures and blood clots. According to several studies, the weakness, critically illness, muscle weakness and muscle atrophy are common in patients who are critically ill, with upto 80% of patients admitted to the ICU developing some form of neuromuscular dysfunction. ICU-acquired weakness is associated with longer durations of mechanical ventilation and hospitalization, along greater functional impairment for survivors. So, early mobilization is best intervention to reduce these complications among mechanically ventilated patients in ICU settings.

Present study gives the evidence that early mobilization is effective in reducing the length of ICU stay in critically ill patients as statistically significant results were found between experimental group1 and experimental group2 in patient's total no. of ICU days till discharge (p= 0.000), total no. of ICU days post enrolment till discharge (p=0.011), first day when out of bed (p= 0.000) and first day of weaning from ventilator (p=0.000).

Similar RCT was conducted by Bezbaruah P, et al. (2012) on the effect of graded early mobilization versus routine physiotherapy on the length of intensive care unit stay in mechanically ventilated patients. Total 15 patients were selected and randomly assigned into both experimental group (n=8) and control group (n=7). The findings of the study revealed that early mobilization was effective to reduce the length of ICU stay. The mean$\pm$SD length of ICU stay in early mobilization and routine physiotherapy was 5.63$\pm$0.518 and 8.00$\pm$0.577, respectively. The difference in length of ICU stay between the two groups was statistically significant (p= 0.001). The mean$\pm$SD days first out of bed in early mobilization and routine physiotherapy were 2.88$\pm$0.641 and 7.71$\pm$0.756, respectively. The difference in days first out of bed between the two groups on the day of discharge from the ICU was statistically significant (p= 0.001). The mean$\pm$SD of days of weaning in early mobilization and routine physiotherapy were 5.38$\pm$0.518 and 7.43$\pm$0.787, respectively. Difference in days of weaning between both groups was statistically significant (p= 0.001).[16]

Another similar study was done by Zhang G, et al. (2018) on the effect of early mobilization for critical ill patients requiring mechanical ventilation: a systematic review and meta-analysis. In this study, there was 18 research studies included in the meta-analysis. The early mobilization in intervention group showed statistically significant results (p=0.0003). In this study, there was no statistical difference in the analysis of length of hospital stay i.e. p= 0.21. The duration of mechanical ventilation, was statistically decreased.[17]

CONCLUSION

The study findings revealed that for length of ICU stay: Statistically significant results were found in total no. of ICU days

till discharge (p=0.00); in total no. of ICU days post enrolment till discharge (p=0.011); in first day when out of bed (p=0.000) and in first day of the weaning from ventilator (p=0.000) between both groups. This study concluded that early mobilization showed better outcome compared to late mobilization in reducing the length of ICU stay in critically ill patients who are on mechanically ventilation support.

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