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EFFECT OF EARLY PROGRESSIVE MOBILITY ON OUTCOMES OF MECHANICALLY VENTILATED PATIENTS WITH ACUTE LUNG INJURY

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Abstract: **Early mobility exercise of mechanically ventilated patients in the intensive care unit is safe and efficient. The aim of the study was to evaluate the effect of early progressive mobility on mechanically ventilated patients' outcomes Design A quasi-experimental research design was used to conduct this research. This study was conducted at trauma intensive care unit at Assiut university hospital. Sample: A total number of 60 patients divided into number study and control group. Tools: Modified patient assessment sheet, patients' outcomes Assessment sheet. Results: The tudy group subjects had lower complications, and better functional status than control group. Conclusion: Implementing early mobility help to decrease complications occurrence and enhance barthel index among mechanically ventilated patient in ICU Recommendations: Provision early mobilization as routine care during mechanically ventilated caring.**

Keywords: **Acute Lung Injury, complications, mechanical ventilation.**

1. INTRODUCTION

Mechanical ventilation is a focal component in the management of patients with acute lung injury (ALI), which uphold gas exchange and allows the respiratory system to rest while the lung improves from injury.**(Fan, et al., 2017).** Bed rest has been appeared to increment reactive oxygen species and inflammatory mediators, causing muscle atrophy and protein catabolism, eventually leading to atrophy, weakness, and functional incompetence, resulting in longer duration of mechanical ventilation, immobilization, and expanded ICU and hospital length of stay (LOS).**(Arias-Fernández et al., 2018).**

Prolonged bed rest and physical activity restraint can result in pressure ulcers, lung atelectasis, aspiration pneumonia, bone mineral loss, muscle atrophy, hypotension, tachycardia, cardiac output decreases, which result in obvious declines in physical function and ICU-AW. This weakness affects both skeletal and diaphragmatic muscles, extends the duration of mechanical ventilation, prolongs the length of stay (LOS) in the ICU and hospital, and increases mortality. Weakness can persist for years after hospital discharge, limiting functional status, and activity of daily living, preventing return to work, and increasing health care needs.**(Wang., 2020)**

Early mobilization meant physical activities carried out within 24-72 hours of mechanical ventilation and continues throughout the ICU stay with appropriate intensity; where their physiological benefits for the patient acting on the circulation, central and peripheral perfusion, ventilation, or state of consciousness. **(Arias-Fernández et al., 2018).**

Early mobilization (EM) classified into passive and active. Where passive mobilization (PM) carried out by critical care nurse to the patient who unable to follow command and it include range of motion, positioning patient from flat to lateral (right and left), prone and sit patient up with bed on fowler or high fowler positions). given instructions to patient to make range of motion, sitting up on bed, and move from bed to chair, cycling on bed, dangling, and ambulating without assistance called active mobilization. **(Leong YL et al., 2017)**

Mobilizing mechanically ventilated patient required critical care nurses to act as a patient advocator, collaborator and executives in over 24 h on a daily basis . also, perform thorough assessment which help to determine what level of mobility is achievable and safe for patient. she assessed presence of comorbidities that may affect management plan, assess the patient's current physiological status to determine readiness for mobility include stable vital signs, ensure that patient's ETT tubes, and all invasive lines were secured during mobilization. Level of consciousness and types of medications, such as vasopressors, might inhibit the introduction of a mobility, that provide her with some insight as to how well the patient may be able to follow instructions **(Kim, et al., 2020)**

2. SIGNIFICANCE OF THE STUDY

In a recent worldwide epidemiological survey, up to 66 % of acute lung injury (ALI) patients who used mechanical ventilators were discharged from the ICU experienced lower exercise capacity than that of healthy controls, and approximately one fourth had difficulty returning to work **(Taito, et al 2016).**

Report of trauma Intensive Care unit at Assuit university hospital for the year 2018-2019, showed that the number of patients admitted to intensive care unit were approximately 932 patients.(about 75% of them were acute lung injury on mechanical ventilation**). (Hospital records of Assuit University 2018-2019).**

Diverse benefits has been revealed in this study as physical activity stimulate the blood circulation through raise the speed of the heart and the strength of constriction, also works on the dilation of the arteries of the body, positioning increase tidal volume and respiratory rate, preserve muscle strength and mass by improving blood flow, and promoting production of anti- inflammatory cytokines, consequently decrease complications occurrence related to immobilization, and improve activity of daily living,

3. OPERATIONAL DEFINITIONS

Early mobilization" (EM)

Refers to the application of physical exercise as passive, active mobilization, and respiratory muscle training, or modern mobilization techniques and capture prominent superiority if it is initiated from an early stage (less than 3 day)

Patient's outcomes:-

Improve functional status, reduce complications occurrence.

Aim of the study:

The aim of this study was to evaluate the effect of early progressive mobility on outcomes of mechanically ventilated patients with ALI

4. RESEARCH HYPOTHESIS

Hypothesis 1:

Patients who participated in the early mobility program had better functional status in ICU secretions and fewer complications.

Hypothesis 2:

The incidence of complications will be lower in the study group than in the control group

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5. PATIENTS AND METHODS

Research Design:

A quasi experimental research was utilized in this study.

Setting:

The study was conducted in trauma intensive care unit at Assuit University Hospital.

Subjects:

Convenience sample of 60 adults, males and females patients who recently admitted to intensive care unit with acute lung injury were randomly classified into two groups. (30 patients in each group)

$$n = \frac{N\ Z^2\ \ ^2}{Z^2\ \ ^2 + N\ e^2}$$

$$n = \frac{932\times (1.96)^2 \times (0.205)^2}{(1.96)^2\times(0.205)^2+932\times (0.05)^2} = 60\text{patient}.$$

Z=1.96 [standard scores] e =0.05 [error] =0.205 [SD]

N=932 [population] n =60 [sample]

Inclusion Criteria: mechanically ventilated patient within 24 hrs hemodynamically stable aged more than 18

Exclusion criteria: excluded from the current study the patients had contraindications to mobilization

Tools:

Two tools were hired to collect data in order to achieve the aim of the study.

Tool I: Patient Assessment sheet. This tool was developed by the researcher after reviewing the related literature **((Morton., and Fontaine., 2018), (Ahnert, et al 2019), (Naved et al., 2011)&**.It includes the following parts:

Part I: -Socio demographic and clinical data: This part includes socio- demographic data, past medical history, current diagnosis.

Part two: this part consists of following categories:

Assessment of hemodynamic parameters adopted from **(Morton., and Fontaine., 2018**). It included temperature, heart rate, blood pressure, and oxygen saturation.

Acute Physiology and Chronic Health Evaluation II (APACHE II) was adopted from**(Knaus etal., 1985)**and reused by **(**Wang **H et al., 2020)**, it is used to measure the severity of disease for adult patients admitted to ICU. APACHE II uses a point score based upon initial values of (12) routine physiologic measurements (temperature, mean arterial blood pressure, heart rate, respiratory rate, oxygenation, arterial pH, sodium, potassium, creatinine, hematocrit, white blood cells and Glasgow coma score), takes account of the patient's age, chronic health condition and physiological variables.

Modified Borg scale adopted from **(Wilson and, Jones 1989).** Reused by **(Johnson et al 2016)** To describe workload during muscle training sessions in terms of perceived dyspnea during physical exercise).The total score ranged from 0 to 10. Where 0 corresponds to "No shortness of breath" to 10 corresponds to "Maximal breathlessness".

This scale consists of 10 items include (no shortness of breath, no oxygen use was 0... very very slight shortness of breath was 0.5…. very slight shortness of breath with usual oxygen was 1…slight shortness of breath, able to accomplish normal activities with baseline oxygen use was 2… Moderate shortness of breath was 3… Somewhat severe shortness of breath was 4 ….Severe shortness of breath was 5… Very severe shortness of breath was (6-7)…very, very severe shortness of breath (8-9)… Maximal breathlessness was 10

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Second Tool: patients' outcomes assessment sheet

Part 1: Barthel Index score was adopted from **(Christakou, et al 2013)** and reused by **(Silveira et al 2018)** is used to measure functional capacity to perform 10 basic activity of daily living with varying weights. Two items (grooming and bathing) were evaluated with a 2-point scale (0 and 5 points); 6 items (feeding, dressing, bowel function, bladder function, toilet use, and stairs) were evaluated with a 3-point scale (0, 5, and 10 points); and 2 items (transferring from bed to chair and back and walking on a level surface) were evaluated with a 4-point scale (0, 5, 10, and 15 points). The BI score was calculated by summing each item. score with a range of 0 (completely dependent) to 100 (independent in basic ADL). Depending on the functional status, patients were divided into: in-dependent (Barthel score between 76 and 100) or dependent for basic daily living activities (< 75 points)

Part 2:- this part covered complications

- Bed sores, atelectasis, Ventilator associated pneumonia, gastrointestinal complication (constipation)

- **Wells criteria for the prediction of deep vein thrombosis DVT: Modi, et al 2016** is a reliable clinical tool to assess the risk of deep venous thrombosis in trauma patients. This includes active cancer (treatment ongoing or within previous 6 months or palliative)was 1…. paralysis, paresis or recent plaster immobilization of lower extremities was 1…. Recently bedridden for more than 3 days or major surgery within 4 weeks was 1…. Localized tenderness along distribution of the deep vein system was 1…. Entire leg swollen was 1…. Calf swelling by more than 3 cm when compared with asymptomatic leg was 1…. Pitting edema was 1…. Collateral superficial veins was 1…. Alternative diagnosis as likely or greater than that of DVT was **-2.** Where score from 2 to 0 mean low probability for DVT, 1 to 2 points: Moderate probability, 3 to 8 points: high probability**.**

Methods

The study was conducted though out three main phases (preparatory phase, implementation phase and evaluation phase).

The study was carried out on three phases:

1- Preparatory phase:

- Development of the sheet

- Researcher granted an official Permission from the head of trauma intensive care unit at Assuit university hospitals after explanation the aim and nature of the study.

Content validity:

Specialists in the field of critical care medicine and critical care nursing from Sohag and Assuit University tested the tools for content related validity and no modifications were done

Pilot study:-

A pilot study was conducted on 10% of the study subjects to test the feasibility and applicability of the tools and time needed to collect the data. The tools were applicable, and the pilot study subjects were excluded from the actual study.

Reliability of this tools were done using Cronbach´s coefficient alpha score; it was 0.795

Ethical considerations:-

1. Research proposal was confirmed from ethical committee in the faculty of nursing.
2. No risk for study subject during application of the research.
3. Common ethical principles in the clinical research has been was followed in this study
4. Informed consent was obtained after explaining the nature and purpose of the study.
5. Confidentiality and anonymity was assured.
6. Study subjects had the right to refuse to participate and/or withdraw from the study without any rational a t any time.
7. Study subject privacy was respect during data collection

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Field work

– The data were collected seven days / week for 14 day in trauma intensive care unit (TICU).

– **Control group: -** The control group subjects were receiving the routine hospital care only and evaluated in the same way as the study group subjects.

Procedure:

– **Study group** –

Hemodynamic Parameters include heart rate, blood pressure and oxygen saturation reading were assessed before intervention.

Level of consciousness was assessed before intervention to determine patient ability to follow instructions and determine level of activity performed

Based on patient tolerance, stability of condition, and awareness, Progression in physical activities was performed, as the following:

1. For patients who unable to perform ROM independently, passive range of motion exercises for each joint in all directions were done while patient in supine position and repeated ten times per session twice daily.

2. The moment that patients were capable to move their extremities by themselves, active assisted and active (independent) range of motion exercises in the sitting position were done.

3. Bedside exercises encompassed turning from side to other on the bed; transfers from the bed to chair, and versa; and able to be in standing position.

4. Once the patient was being stable and extubated breathing exercise was added to active range of motion of extremities, and the patient was allowed to walk according to patient tolerance

During exercise patient hemodynamic parameter were monitored to ensure patient safety then assessed after one hour.

Level of dyspnea during exercise by using Borg scale was assessed once patient able to express it

At the day of discharge, patients' ability to perform ADLs were observed and recorded.

Physical exercise should be terminated if patient begin to experience any of the following condition

1) changes in heart rate Heart rate <50 or >140 b/m
2) abnormal cardiac rhythm
3) respiratory rate > 20 breaths per minute
4) Extreme fatigue or pallor /sweaty and patient request to stop the activity
5) SpO2 drop >10% of resting level

Evaluation phase

– Complications were recorded once occurred

– Barthel index was calculated in the stable state, one week before admission, and it was obtained from the caregiver or from patient if cooperative. Then measure at the day of discharge

Statistical analysis

All data were recorded in a special chart for every patient. The collected data were coded, analyzed and tabulated .Data entry and analysis were done using SPSS 19.0 statistical software package. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and means and standard deviations for quantitative variables. Quantitative continuous data were compared using analysis of variance test in case of comparisons

between two independent groups. Using independent T-test and chi-square test to determine significant, it is considered significant when $P \leq 0.05$ significant and non- significant when $P > 0.05$.

6. RESULTS AND ANALYSIS OF DATA

Table (1): personality distribution of demographic and clinical data in the study and control groups (n=60)

socio-demographic	Study (n= 30)		Control (n=30)		P-value
	No.	%	No.	%	
Age: (years)					0.461
Mean ± SD	50.27± 12.98		52.77± 13.13		
Sex:					1.000
Male	17	56.7%	17	56.7%	
Female	13	43.3%	13	43.3%	

Chi-square test& Independent samples t-test. * Statistical significant difference ($p<0.05$)

Table (2): Comparison between the study & control groups as regard Clinical data (n=60)

Clinical data	Study (n= 30)		Control (n= 30)		P-value
	No.	%	No.	%	
Past-medical disease:					0.226
Yes	5	16.7%	8	26.7%	
No past history	26	83.3%	22	73.3%	
Current diagnosis:					0.883
Brain edema	6	20.0%	5	16.7%	
Lung contusion	13	43.3%	10	33.3%	
Multiple fracture	5	16.7%	6	20.0%	
Pneumonia	2	6.7%	3	10.0%	
Sepsis	4	13.3%	6	20.0%	
APACHE II score	Mean ± SD				
At admission	16.03 ± 3.36		19.67± 2.011		0.000*
At discharge	16.47 ± 3.88		20.17±2. 63		0.000*

Chi-square test& Independent samples t-test. * Statistical significant difference ($p<0.05$)

APACHE II score: Acute Physiologic Assessment and Chronic Health Evaluation

Table (3): Comparison between the study & control groups as regard hemodynamic parameters (n=60)

hemodynamic parameters	Before intervention(baseline)			After intervention		
	Study (n= 30)	Control (n= 30)	P-value	Study (n= 30)	Control (n= 30)	P-value
	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
1st day						
HR	92.60 ± 11.45	92.80± 11.19	0.785	97.50 ± 11.07	100.33 ± 9.66	0.295
SBP	118.33±11.52	120.23±17.50	0.621	115.47± 12.76	121.73± 23.30	0.201
DBP	77.97±9.43	77.57±8.82	0.866	78.10± 8.62	79.67± 8.82	0.489
Spo2	89.07±4.37	87.13±4.73	0.106	91.13±4.33	88.27±4.20	0.012*

3rd day						
HR	88.77±11.44	92.97±11.72	0.166	91.73±9.73	94.10±10.52	0.370
SBP	118.53±9.69	121.27±14.69	0.399	118.03±11.66	121.53±16.15	0.340
DBP	79.83±6.57	81.53±9.78	0.433	80.97±6.30	81.70±8.44	0.705
Spo2	92.37±2.14	92.03±1.95	0.531	92.77±1.97	91.90±2.82	0.107
7th day						
HR	86.23± 7.64	92.00± 9.50	0.012*	88.93± 7.18	93.63± 8.29	0.022*
SBP	117.90± 6.26	118.13± 11.14	0.634	116.60± 8.27	117.83± 11.45	0.338
DBP	80.03± 6.01	81.90± 8.69	0.338	78.83± 6.24	82.10± 9.54	0.122
Spo2	92.93±2.31	92.23±2.65	0.272	93.30±1.96	92.70±2.54	0.312
10th day						
HR	88.43± 10.21	93.40± 8.65	0.047	91.30± 8.37	94.60± 7.80	0.121
SBP	118.43± 7.70	119.20± 10.74	0.752	114.70± 6.72	120.40± 9.84	0.011*
DBP	80.97± 5.75	83.87± 6.52	0.073	80.83± 4.14	82.13± 7.33	0.403
Spo2	95.63±2.44	92.97±2.67	0.000*	95.20±2.53	93.43±2.83	0.000*
14th day						
HR	84.30± 9.53	92.93± 9.14	0.001*	87.20± 9.63	93.67± 8.66	0.008*
SBP	114.97± 7.07	117.87± 7.47	0.128	114.23± 7.28	117.93± 6.86	0.048*
DBP	81.03± 5.01	84.80± 5.62	0.008	80.80± 3.31	83.97± 6.03	0.015*
Spo2	96.73±2.46	93.87±3.65	0.001*	96.20±2.75	93.67±3.49	0.003*

Chi-square test P >0.05 non significant *P<0.05 significant

Table (4): Modified Borg scale of dyspnea that measured during exercise on study group (n=30)

	Study(n= 30)		**P-value 1**
	Mean ± SD		
	First time	Second time	
After extubation	5.20 ± 1.66	3.04 ± 0.98	0.000*
At discharge	3.68 ± 0.75	0.30 ± 0.47	0.000*
P-value 2	0.035*	0.000*	

Independent samples t-test P >0.05 non significant. P <0.05 statistical significant difference

P-value 1Comparison between Borg scale on first & second time. P-value 2Comparison between Borg scale on extubation & discharge day.

Table (5): Comparison between both study & control groups in relation to Barthel index score (n=60)

Barthel index score	**Study (n= 30)**	**Control (n= 30)**	**P-value**
	Mean ± SD	**Mean ± SD**	
Baseline	92.33 ± 18.37	94.00 ± 7.47	0.647
	Range 80-100	**Range** 50-75	
At discharge	67.14± 4.60	59.62± 9.99	0.001*
	Range 75-100	**Range** 45-80	

Independent samples t-test P >0.05 non significant. P <0.05 statistical significant difference

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Table (6): Comparison between both study & control groups in relation to complications (n=60)

Complications	Study (n= 30)		Control (n=30)		P-value
	No.	%	No.	%	
gastrointestinal complication	2	6.7%	8	26.7%	0.040*
Deep venous thrombosis	0	0.0%	3	10.0%	0.119
Ventilator associated pneumonia	2	6.7%	8	26.7%	0.040*
Progressive ARDS	3	10.0%	9	23.3%	0.049*
Bed sores	2	10.0%	10	33.3%	0.011*
Pnuemothorax	2	6.7%	7	23.3%	0.073

Chi-square test P >0.05 non significant. P <0.05 statistical significant difference

Table (1) represents personality distribution of demographic and clinical data in the study and control groups. It was found that the mean age in intervention group was 50.27± 12.98 years versus 52.77± 13.13 years in control group with no statistical significant difference (p=0.461). Also, greater than half of sex in both groups was male with no statistical significant difference.

Table (2) represents comparison between the study and control groups as regard their clinical data. It noticed that the most common current diagnosis was lung contusion in both study and control groups. Also, more than half of study and control groups with no past medical history (86.3% vs. 73.3% respectively), and APACHE II score in study group lower than that of control group

Tables (3) mentions that no statistical significant differences between the two groups as regarded hemodynamic parameters before intervention, also there was slight increase in heart rate in study group after intervention (after 1 hrs) but still with the normal range.

Table (4) shows that there were significance differences regard to modified Borg scale for dyspnea during exercise between after extubation and at discharge among study group.

Table (5): Comparison between both study & control groups in relation to functional status through Barthel index score. it was noticed Barthel index at discharge in the study group better than that of control group but with statistical significant difference (P<0.05)

Table (6)shows that there higher percentage of complications occurred among subjects of control group comparing with subjects of study group.

7. DISCUSSION

Acute onset of respiratory failure with protein-rich pulmonary edema attributable to increased permeability of alveolar epithelium and endothelial injury in pulmonary vessels is the characteristic features of acute lung injury (ALI) **Kubat. et al., 2019**.Mobilizing critically ill patients confined in the ICU and positioning them in order to prevent joint contractures is an early rehabilitative mechanism that has significant effects on oxygen transportation, maintenance of muscle strength and joint mobility, and lung function and respiratory system performance.

The discussion will cover the main result findings as follows:

Regarding The personal characteristics, our study patients show that mean age of patients was 50.27± 12.98 years old in study group and 52.77± 13.13 years old in control group with no significant difference between both groups. Our findings advocated by the findings **Dong, et al (2014)** who reported that there was no significant difference in age, gender between treatment and control groups when investigate the effect of twice session of early mobilization on patients with mechanical ventilation

Our findings disagree with **Hariedy N et al., (2015)** who found that Root traffic accident& multiple fractures were most common diagnosis among both group when investigated 60 patients performing twice daily of CPT on acute lung injury

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Elicker et al 2016 reported that highest incidence of ALI is seen in patients over the age of 75. And the most common causes of ALI were pneumonia.

Regarding APACHE II score, the present study showed that mean value on admission was (16.03 ± 3.36) for study group which was lower than that for control group (19.67 ± 2.01),this was in agreement with **Mendez-Tellez et al 2013** when assessing "Factors associated with timing of initiation of physical therapy in 503 patients with acute lung injury", they reported and pneumonia was causes of primary lung injury and the mean valve of APACHE II score on ICU admission was lower in study group (19.0) while (22.0) in control group.

Results of this study agreed with **Wang, et al 2018** who reported that mean APACHE II score at admission in the intervention and control groups (19.4 ± 8.7& 21.2 ± 9.1 respectively with p=0.09) when evaluating the effect early mobilization. in study group. While a control group received routine nursing chest care.

Regarding hemodynamic parameters, hemodynamic parameters before intervention, also there was slight increase in heart rate in study group after intervention (after 1 hrs) but still with the normal range.

Our findings compatible with the results of **Younis and Ahmed 2012** study. Who conducted "the effect of passive range of motion exercises on hemodynamic parameters and behavioral pain intensity among adult ventilated patients". They reported that a significant decrease of oxygen saturation, systolic and diastolic blood pressure during passive exercises.

Our study disagreed with **Camargo et al (2013)** who revealed that applying early exercise for mechanically ventilated patients in the ICU didn't show clinically relevant changes in any of the hemodynamic variables such as heart rate, MAP, CVP and SaO2

Stiller et al (2004) in a study about "the safety of mobilization and its effect on hemodynamic and respiratory status of intensive care patients", found that mobilization was associated with significant changes for HR and BP but the magnitude of the changes was of a minor clinical importance. Also, this study showed that a transient decrease in oxygen saturation during intervention.

As regarded to assessing patient ability to perform activity of daily living

Our study revealed that there was no statistical significant difference between both group as regarded of Barthel index pre admission data while improvement of Barthel index post physiotherapy in the test group better than control group with statistical significant difference (P<0.05) was shown at discharge

Nafae et al 2018 studied the benefits and risks of delivering multimodal Physiotherapy to mechanically ventilated patients they found improvement of Barthel index post physiotherapy in the test group better than control group but without statistical significant difference (P>0.05) and there was statistical significant difference regarding mean of Barthel index in the test group pre and post sessions (P<0.001).

It agreed with the results of **Schweickert et al. 2009** who found that patients started physiotherapy within 24h from ICU admission, had higher Barthle index score at hospital discharge 75 in test group and 55 for control group with (P=0.05).

Chiang et al. 2006 who studied physical training effects on functional status in prolonged mechanically ventilated patients found that pre-admission Barthel index score was the same between both group then it was shown significantly improved at ICU discharge in test group while unchanged in control group. Despite of the median BI score decreased significantly (P_.001) compared with the pre-admission score in both group

Davis et al. 2013 when evaluate functional outcomes associated with providing early mobilization to critically ill reported decrease in barthel index at hospital discharge compared to preadmission findings

Our result is agreed with finding of **Schaller et al (2016)** who shown that Early mobilization therapy in the intensive care unit increased patients' mobility level, and improved functional independence at hospital discharge.

Zhang et al. 2019 assess if early mobilization in the intensive care unit (ICU) could improve functional recovery. They reported that The mean Barthel Index score at hospital discharge was 80.32 ± 10.68 for study group and 58.93 ± 10.41 for control.

Schujmann et al., 2020 mentioned that patients undergoes progressive mobility had better functional status compared with those in the control group (96% vs 44%; $p < 0.001$).

As regarded to Complications

our study shows that two patients of study group developed oxygen de-saturation during exercise. Also there was higher percentage of complications among subject of control group.

Castro et al., 2015 found that patients admitted in study group presented a lower incidence of respiratory infections ($p = 0.004$) than patients admitted control group.

Zhang et al 2019,The incidence of deep vein thrombosis in the study group and control group was 0.5% and 7.6%, respectively. The aggregated result showed that early mobilization was associated with a significantly lower incidence of deep vein thrombosis than control

Wang TH., 2020, implementation of physical exercise sufficient to promote an acute physiological effect that improves ventilation, circulation, perfusion, muscle metabolism, and alertness and reduce rates of venous stasis and deep vein thrombosis.

Denehy L et al 2017 EM has a affirmative effect on the body systems as mobility helps to improve ventilation-perfusion matching, elevates the efficiency of the respiratory mechanism, and improves airway clearance, decrease blood stasis , thence, reduce risk of developing DVT and thrombo embolism, also improved gastrointestinal motility.

8. CONCLUSION

Based on the findings of the present study, it can be concluded that: patients who engaged in an early mobility program had better functional status at discharge from the ICU and lower complications rate

Based on the finding of the current study, the following recommendations are suggested:

- Incorporate of early mobilization as a routine care for critically ill patients
- Future researches are recommended to include information about the follow-up of these patients out of ICU.

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