EFFECT OF EARLY MOBILIZATION ON NURSING SENSITIVE QUALITY INDICATORS AMONG MECHANICALLY VENTILATED OBESE PATIENTS

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ABSTRACT

Background: Patients admitted to the intensive care units (ICUs) are generally confined to bed, this leading to limited mobility. Because of this situation, patients may have detrimental effects on their different body systems. Early mobilization (EM) can prevent or reduce these effects and improve outcomes in critically ill patients (CIPs).

Purpose: This study aims to assess the effect of early mobilization on nursing sensitive quality indicators among mechanically ventilated obese patients.

Methods: A Quasi-experimental research design was utilized. Also, data was collected cross a period of 6 months from the intensive care units at the University Hospital. A convenient sample of 100 adults were divided randomly for both study and control groups (50 for each).

Results: 52% of control group suffered from ventilator associated pneumonia (VAP) compared to 24% of study group with a high statistically significant difference at p value <0.01. 64% of control group suffered from decubitus ulcer compared to 36% of study group with slight significant difference at p value <0.05. While 32% of control group suffered from delirium compared to 18% of study group with a slight significant difference at p value <0.05. Length of stay (LOS) of control group was 13.96±4.62 days compared to 10.64±2.60 days of the study group.

Conclusion: Based on the study findings, early mobilization decreasing occurrence of VAP, decubitus ulcer, delirium and length of stay at ICU. Also, early mobilization of obese mechanical ventilated patient (OMVPs) had positive effect on respiratory rate, heart rate, systolic pressure, diastolic pressure and O2 saturation.

Keywords: mechanical ventilation; mobilization; nursing care; obesity; quality indicators.

I. INTRODUCTION

Obesity is among the most serious public health problems.[1] It has extensive medical, social, and economic consequences. [2] Its incidence has increased rapidly during recent decades. [3] According to World Health Organization in 2020, 2.8 million people are estimated to die annually due to the consequences of obesity, and obesity-related healthcare costs are estimated to be $80 billion annually.

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In recent years, the prevalence of obesity in ICUs has increased. Approximately one third of ICU patients have been confirmed to have obesity. [4] Obesity is associated with an increased risk of experiencing a variety of serious medical problems, so obese patients (OPs) are expected to be at greater risk of referral to hospitalization and intensive care units (ICUs) than non-obese people. [5] 'Usually, obesity in critically ill CIPs is associated with elevated morbidity, mortality, prolonged mechanical ventilation (MV) length, longer ICU stays, and increased health care costs, increased risk of thromboembolic disease, pressure ulcers, deconditioning, and impaired physical function. [6]

Mechanical ventilation is hampered in OPs by reduced lung and chest wall compliance and increased airway obstruction, and weaning from the MV can be more difficult. Moreover, OPs have been reported to have raised the risk of nosocomial infections fourfold. [7] Owing to higher gastric residual volume, elevated intra-abdominal pressure, and a higher frequency of gastric reflux, the risk of VAP is also increased. Around 10-30 per cent of mechanically ventilated patients (MVs) produce VAP, with a 30-40 per cent mortality rate. [8]

In addition, OPs are at high risk of developing pressure ulcers (PU) during their ICU stay due to their weight, quickly compromised drainage in dependent areas and difficult wound dressing. [9] Obesity also tends to immobility, which is a risk factor that is predisposed to delirium. Delirium, marked by an abrupt reduction in cognitive functioning, is a normal, dangerous and often fatal medical disorder. [10]

Early mobilization may increase the strength of patient muscle, decrease the duration of MV and improve the quality of life of patients, improve patient outcomes, especially decrease in ICU length of stay shorter delirium duration, and is associated with low adverse effect rates. [11,1]

While recent studies have shown that EM of ICU patients is healthy, feasible and helpful, it is difficult to mobilize OPs. [12] Obesity is one of the obstacles to mobilization, and furthermore, in seriously ill OPs early mobilization has not been precisely tested. Fortunately, the Progressive care nurses have core competencies that enable them to safely and effectively care for OPs. A plan of care with interdisciplinary collaboration illustrates the integrative care for obese progressive care patients. [13]

Therefore, this research was undertaken and the nursing-sensitive measures (NSIs), including pressure ulcer, duration of stay, VAP and delirium, were used to determine the nursing outcomes. The collection of data for identifying and evaluating nursing outcomes on patient's care or a health care system is often referred to as “Nurse-Sensitive Outcomes or indicators Nursing-sensitive indicators (NSIs) are central measures that provide standardized numerical data to evaluate the quality of nursing care, implement quality improvement initiatives, maintain cost efficiency, and develop resource plans. [14] It includes occurrence of ventilator associated pneumonia (VAP), occurrence of delirium, occurrence of decubitus ulcers and Length of stay (LOS) at ICU. [15]

Purpose of the study: The present study aimed to assess the effect of early mobilization on nursing sensitive quality indicators among mechanically ventilated obese patients.

Research hypothesis of the current study: The study hypotheses that early mobilization of obese mechanical ventilated patient will have positive effect on Nursing Sensitive Quality Indicators.

II. METHODS

Research Design:
Quasi-experimental research design was used in the present study.

Participants:
A convenient sample of 100 adults’ MVOPs of either sex who were newly intubated within 24-48 hours after ICU admission were included in the study and divided randomly for both the study and control groups (50 for each).

Inclusion criteria:
Newly intubated patients within 24-48 hours after ICU admission, obese (body mass index ≥ 30), fully conscious with no use of sedatives, or muscle relaxants, and able to understand and follow commands appropriately, able to mobilize hemodynamically stable (mean arterial pressure [MAP] ≥ 60 mmHg without vasopressors or inotropes), oxygen saturation (Sao2) ≥ 90%, HR: 60-120 b/min, Fio2<60%, PEEP <10 cmH2O

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Data collection:
Data was collected across a period of 6 months from the intensive care units of the University Hospital. Permission was obtained from responsible authorities to conduct the study. Furthermore, two tools were used to collect the data of this study. Tool I was developed by the researcher after reading the related literature and used to assess patients’ demographic data and physiological parameters. It included two parts: Part I: includes Patients’ characteristics as age, gender, weight, height, BMI, patients’ diagnosis and past medical history. Part II: includes Patients Physiological Parameters: This part was used to monitor physiological parameters as “respiratory rate, heart rate, systolic pressure, diastolic pressure and O2 saturation” and MV parameters. Moreover, Tool II (Early mobilization Outcomes) was developed by the researcher after reviewing the related literature to assess the nursing sensitive outcome indicators after mobilizing MVPs. [16] This tool included 4 parts; Part I which included the occurrence of ventilator associated pneumonia (VAP). The occurrence of VAP will be obtain from the patients’ record by checking the result of the patients’ respiratory secretion cultures and chest x-ray and confirmed diagnosis of VAP. Part II that include the occurrence of delirium. Occurrence of delirium was assessed by using Intensive Care Delirium Screening Checklist (ICDSC). [17] “The score for each item will be assigned as follows: Obvious manifestation of an item = score one and no obvious manifestation of an item = score zero. The patient was be classified as delirious when the total score > 4 on any given day while a total score of < 4 denoted that the patient was not-delirious”. Part III that include the occurrence of decubitus ulcers: Occurrence of decubitus ulcers and its stages will be assessed using Braden Scale. Part IV (Monitor the Length of stay) at ICU. Length of ICU stay was measured and recorded as occurred or not. In addition, five experts of critical and medical/surgical nursing ascertained the content’s validity. Reliability testing used to test the reliability in terms of Cronbach's Alpha for tool was 0.856.

Ethical consideration
Approval from ethical committee was obtained. Moreover, Permission from hospital manger was obtained to collect the data. A written informed consent from the study subjects was voluntary obtained after explanation the aim of the study. Participants' privacy and safety were ensured. Confidentiality, privacy, and anonymity of students and their responses assured through the phases of the study.

Field work:
A cross a period of 7 days, early mobilization was done for the study group, while the control group gets the routine nursing care. Early mobilization, consisting of 6 steps (Step 1: HOB elevated to 45, step 2: HOB elevated to 45 and legs in dependent position, step 3: HOB elevated to 60° and legs in dependent position, step 4: dangling position, step 5: chair sitting position and step 6: walk with assistance) was carried out for patients every day. If patients tolerate mobility therapy, they passed to the next step of EM. Early mobilization was done once during the morning and evening shift. It is worth mentioning that in order to maintain the patients' safety, help was offered from internship and staff nurses from ICUs after training them on the mobilization steps. Physiological parameters were assessed and documented by using part 2 of tool 1 at five minutes and 15 minutes after completion of each mobility intervention. Early mobilization outcomes were assessed by using tool II. While in the control group, a previously described instruments were used to assess the patient's condition after providing routine nursing care for a period of 7 days.

Data analysis:
Analysis of data done using percentage, mean, standard deviation, and t test. Significant level measured at P value of ≤ 0.05.

### III. RESULTS

| Table 1: Distribution of the control and study groups according to patients’ demographic data (N=100). |
|---------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------------------|
| **Age** | **Control group (n=50)** | **Study group (n=50)** | **T test (P value)** |
| **N** | **%** | **N** | **%** | **N** | **%** |
| 23 - <43 | 14 | 28 | 15 | 30 | 0.850 (.399) |
| 43 - <63 | 22 | 44 | 21 | 42 |
| 63 –83 | 14 | 28 | 14 | 28 |
Table 1 revealed that the mean age of control group was 51.5±15.7 year, while the mean age of study group was 51.5±15.56 year. As regard to gender, it was found that 48% of the control group and 50% of study group were female. In relation to the mean of weight, height and BMI in the control group, it was found that 88.01±8.55kg, 166.19±5.99cm and 31.77±1.86, respectively. While at the study group was 86.77±7.84kg, 165.97±6.27 cm and 31.74±1.80, respectively. Also, related medical history and diagnosis showed that there was no significant difference between control and study group.

Table 2: Distribution of the control and study group regarding the mechanical ventilation parameters. N= 100.

<table>
<thead>
<tr>
<th></th>
<th>Mean score of Control group</th>
<th>Mean score of Study group</th>
<th>T test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPAP</td>
<td>15</td>
<td>15</td>
<td></td>
<td>.322</td>
</tr>
<tr>
<td>SIMV</td>
<td>19</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSV</td>
<td>8</td>
<td>6</td>
<td>1.000</td>
<td>.322</td>
</tr>
<tr>
<td>CM</td>
<td>6</td>
<td>8</td>
<td></td>
<td>.132</td>
</tr>
<tr>
<td>AC</td>
<td>2</td>
<td>2</td>
<td></td>
<td>.456</td>
</tr>
<tr>
<td>Mean FiO₂</td>
<td>47.20±4.53</td>
<td>48.60±3.50</td>
<td>1.999</td>
<td>.051</td>
</tr>
<tr>
<td>Mean Air way pressure</td>
<td>13.50±2.47</td>
<td>13.34±2.39</td>
<td>1.385</td>
<td>.172</td>
</tr>
<tr>
<td>Mean Pressure support</td>
<td>15.87±1.02</td>
<td>15.87±1.02</td>
<td></td>
<td>----</td>
</tr>
<tr>
<td>Mean Tidal volume</td>
<td>491.66±19.03</td>
<td>488.70±25.53</td>
<td>1.308</td>
<td>.132</td>
</tr>
<tr>
<td>Mean PEEP</td>
<td>5.140±0.40</td>
<td>5.16±0.23</td>
<td>0.986</td>
<td>.456</td>
</tr>
</tbody>
</table>
Table 2 indicated that, there was no significant difference between control and study group in relation to the mode of MV at p value >0.05. Also, it was found that mean of FiO2, the mean airway pressure and the mean pressure support at control group was 47.20±4.53, 13.50±2.47 and 15.87±1.02, respectively while at study group was 48.60±3.50, 13.34±2.39 and 15.87±1.02, respectively with no significant difference at p value >0.05. According to mean tidal volume and PEEP at control group was 491.66±19.03 and 5.140±0.40 while at study group was 488.70±25.53 and 5.16±0.23 with no significant difference at p value >0.05.

Table 3: Comparison between means of control and study group regarding physiological parameters before and after implementation of early mobilization. N=100.

<table>
<thead>
<tr>
<th>Physiological parameters</th>
<th>Mean score of Control group</th>
<th>Mean score of Study group</th>
<th>T test</th>
<th>P value</th>
<th>Mean score of Control group post</th>
<th>Mean score of Study group post</th>
<th>T test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory rate</td>
<td>18.84±3.40</td>
<td>18.70±3.44</td>
<td>1.999</td>
<td>.051</td>
<td>19.42±3.56</td>
<td>21.48±2.94</td>
<td>6.196</td>
<td>.000**</td>
</tr>
<tr>
<td>Heart rate</td>
<td>87.16±8.23</td>
<td>87.38±7.72</td>
<td>1.157</td>
<td>.253</td>
<td>87.42±8.01</td>
<td>90.12±8.10</td>
<td>11.041</td>
<td>.000**</td>
</tr>
<tr>
<td>Systolic blood pressure</td>
<td>135.90±5.36</td>
<td>135.90±5.11</td>
<td>0.000</td>
<td>1.000</td>
<td>137.06±5.83</td>
<td>138.00±5.88</td>
<td>4.198</td>
<td>.000**</td>
</tr>
<tr>
<td>Diastolic blood pressure</td>
<td>85.60±2.86</td>
<td>85.20±2.84</td>
<td>1.838</td>
<td>.072</td>
<td>87.40±3.33</td>
<td>88.12±3.49</td>
<td>2.137</td>
<td>.038*</td>
</tr>
<tr>
<td>SO2</td>
<td>94.08±6.61</td>
<td>93.98±6.58</td>
<td>1.219</td>
<td>.229</td>
<td>94.94±1.28</td>
<td>93.97±2.01</td>
<td>2.684</td>
<td>.033*</td>
</tr>
</tbody>
</table>

Table 3 presents that there was no significant difference between study and control group related respiratory rate, heart rate, systolic blood pressure, diastolic blood pressure and SO2 before intervention with p value >0.05. While, there was highly significant difference between study and control groups related respiratory, heart rate and systolic pressure at p value <0.01. Meanwhile, there was slight significant difference related diastolic blood pressure and SO2 with p value <0.05.

Table 4: Comparison between the study and control groups in relation to the VAP, decubitus ulcer, and delirium (N = 100).

<table>
<thead>
<tr>
<th></th>
<th>Control group</th>
<th>Study group</th>
<th>T test</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group No</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VAP</td>
<td>26</td>
<td>12</td>
<td>2.714</td>
<td>.009**</td>
</tr>
<tr>
<td>Decubitus ulcer</td>
<td>32</td>
<td>18</td>
<td>2.516</td>
<td>.012*</td>
</tr>
<tr>
<td>Delirium</td>
<td>16</td>
<td>9</td>
<td>2.632</td>
<td>.046*</td>
</tr>
</tbody>
</table>

Table 4 indicated that the incidence of VAP was higher in control group (52%) than the study group (24%) which indicated high significant difference at p value <0.01. Also, 64% of control group suffered from decubitus ulcer, while 36% of study group which indicated slight significant difference at p value <0.05. And, 32% of control group suffered from delirium, while 18% of study group which indicated slight significant difference at p value <0.05.

Figure 1: Comparison between control and study group related mean of length stay N = 100.
Figure 1 reported that mean length of ICU stay of control group was 13.96±4.62, while of study group was 10.64±2.60, with high significant difference between two groups at p value <0.01.

IV. DISCUSSION

Immobility can cause several complications, including skeletal muscle atrophy and weakness, that influence the recovery of critically ill patients. This effect can be mitigated by early mobilization. Early mobilization is associated with better functional outcomes and should be performed whenever indicated. Early mobilization is safe and should be the goal of the entire multidisciplinary team. [18]

The current study found that the eligibility criteria previously determined by researchers had already been used in all surveyed patients enrolled in two groups, also detected that there was no significant difference between study and control group related age, gender, weight, height, BMI, past history and medical diagnosis. Moreover, there was no difference between ventilator parameter as Pressure support, PEEP, TV, Fio2 and Air way pressure for patients at both group. So, the effect that detected by this study completely due to the intervention without any individual difference between patients included at study and control group.

After analyzing and interpretation of the collected data, it was found that there was highly significant difference between study and control groups in relation to respiratory rate, heart rate and systolic pressure. Meanwhile, there was slight significant difference related diastolic blood pressure and SO2. These results may due to early mobility encourage circulation which improves heart rate and blood pressure. These results were in agreement with the study conducted by Alaparthi et al. (2020) and Zhang et al. (2019). [19,20] They demonstrated that early mobilization was established to have positive effects on many outcomes in patients without or connected with mechanical ventilation. Also, Doiron et al. (2018) stated that mobilization had stability on hemodynamic state of the patient. [21]

Clinical outcomes in the post cardiac surgery patients:

Ventilator-associated pneumonia is the most frequent life-threatening nosocomial infection in intensive care units. About 10-30% of the MVPs develops VAP, with a mortality rate of 30-40 %.[22]

The present study revealed that more than half of control group suffered from VAP, while only less than one quarter of study group and there was high significant difference between the two groups. These results consistent with the study conducted by Sigler et al. (2016) and Taito et al.(2016) who showed that early mobilization is safe and valuable in critically ill patients. [23,24] Larsen et al. (2019)stated that early mobilization had positive effect on patient with ventilator associated pneumonia. [25] Also, these results in agreement with Wang et al. (2020) and Bergbower et al.(2020). [26,27] They detected that early mobilization improved ventilator-associated pneumonia and reduced its incidence in patients.

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In relation to decubitus ulcer, it was reported that Hospital-acquired pressure ulcer (HAPU) is one of the top 5 adverse events. It has a significant financial burden to the hospitals. Its incidence in ICUs ranges from 8.8 to 23%. The occurrence of PUs is an indicator which reflects quality of care and hospital safety. Poor outcomes related to PU may result in increased length of stay, increased pain and discomfort, decreased patient and family satisfaction, and increased hospital costs. [28]

The result of the current study revealed that less than two thirds of control group compared to slight more than one third of study group suffered from decubitus ulcer with slight significant difference between the groups. Also, these results in agreement with the study by Wang et al. (2020) and Bergbower et al. (2020) who detected that early mobilization reduced the incidence of intensive care unit-related complications such as pressure sores.[26,27]

Regarding to delirium, Delirium is a common, serious and sometimes fatal medical condition, characterized by an acute decline in cognitive functioning. [29] Moreover, Wang (2020) reported that it occurs in 60–80% of MVPs. [30]

The result of the current study showed that about one third of control group suffered from delirium, while less than one fifth of study group which indicated slight significant difference. These results consistent with the study conducted by Sigler et al. (2016) and Taito et al. (2016) who showed that early mobilization is safe and valuable in critically ill patients. [23,24] On contrary, Wang et al. (2020) showed that there were no statistically significant differences in delirium rate. [26]

In relation to length of stay at ICU, the results of the current study showed that the mean length of ICU stay of control group was higher than that of the study group with high significant difference between two groups. These results may be occurred because the control group had VAP and decubitus ulcer than study group, which may exceed their stay to treat these problems. These results cohort with the study by Zang et al. (2020) who mentioned that early mobilization for critically ill patient was effective in reducing length of ICU stay. [31] Also, similar with Hunter et al. (2020) and Escalon et al. (2020) who detected that length of stay of patients on mechanical ventilation in the ICU was limited with statistical significance due to early mobilization. [32,33] While, inconsistent with the study performed by Coles et al. (2020) who reported that length of stay and number of ventilator days between the two groups were similar. [34]

V. CONCLUSIONS AND LIMITATIONS

The findings of the current study concluded that, early mobilization decrease occurrence of VAP, decubitus ulcer, delirium and length of stay at ICU. Also, early mobilization of obese mechanical ventilated patient had positive effect on respiratory rate, heart rate, systolic pressure, diastolic pressure and O2 saturation. Regarding to the limitations of the study, the generalizability of its results were threatened due to the small sample size and non-randomization sample selection in addition to conduction of the study in one facility.

Recommendations

- Stakeholders support and advocacy by leadership to sustain early mobility measures in intensive care units
- Provision of training program to reinforce critical care nurses practices of early mobility interventions.
- Use protocol for standardized mobilization for mechanically ventilated obese patients.
- Replicate the study with randomized and large sample to increase generalizability of results and to determine long term outcomes.

Conflict of interest

None

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