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Effect of Implementation ICU Liberation Bundle on Critically Ill Patients Outcomes

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Abstract
Patients with intensive care unit require mechanical ventilation for a number of reasons. Although it has advantages, there could be a higher chance of serious consequences. Therefore, an evidence-based series of procedures referred to as the liberation bundle when taken together, will improve the prognosis for patients on mechanical ventilation. **Aim of study:** This study aimed to investigate effect of implementation ICU liberation bundle on critically Ill patients outcomes. **Design:** Quasi experimental research design was used to conduct this research. **Setting:** This study was carried out at intensive care unit at Asyut University Hospitals. **Sample:** 60 patients, divided equally into study and control groups30 patients for each. **Tools** included four tools **Tool 1:** Patient assessment sheet **Tool 2:** Assessing muscle strength sheet **Tool 3:** Family Engagement Assessment Sheet **Tool 4:** Patients outcomes assessment Sheet**. Results:** - Findings of the present study revealed that study group had lowered the mean pain score was 1.17±1.63compared to 5.40±1.43 for the control group. Also study group had a significantly shorter time of mechanical ventilation connection 1.63±0.96 days for study group and 8.58±3.82 for control group that resulting in shorter length of hospital stays for the study group 7.83±1.29 compared to control 17.10±4.46. **Conclusion:** Implementing liberation bundle is an effective approach in critically ill patients and it has lower intensive care stay duration, lower mortality rate and period on ventilator. **Recommendation:** Encouraging early mobilization, family involvement, and the implementation the liberation bundle for patients in intensive care units to enhance patient outcomes.

Keywords: Critically ill, Intensive Care Unit, Liberation Bundle & Patients Outcomes

Introduction
During their hospital stay, critically sick patients may endure a range of uncomfortable symptoms, such as pain, agitation, psychosis, weakness, and lack of sleep. These symptoms are frequently treated by keeping patients deeply sedated, immobile, and frequently socially isolated due to the complexity of caring for ICU patients. In the past, team members worked in compartmentalized care systems with daily goals of care arranged according to specific organ failure rather than an integrated holistic approach. **(Devlin et al, 2018).**

The care approach is a useful strategy for lowering mechanical ventilation related complications. Research-backed therapies, known as care bundles, consist of three to five evidence-based interventions that have been demonstrated to enhance patient outcomes. The use of bundles can enhance and complement the standard of care provided in intensive care units. **(Mohamed et al., 2023).**

The ICU Liberation Bundle consists of six evidence-based therapies that work better when used in tandem than when used separately. Multidisciplinary teams collaborate to deliver the best care possible, supported by evidence-based research and practices, with the ultimate goal of improving patient care. Care bundles can be used to ensure the delivery of the minimum standard of care. Care bundles are a collection of interventions that, when used together, significantly improve patient outcomes. **(Taksande et al., 2020).**

The ICU liberation bundle involves assessments for delirium, pain, and readiness to begin spontaneous breathing trials and discontinue sedation. It also promotes early patient mobilization, avoidance of restrictions, and bedside rounds involvement with the family to enhance communication. In a dose-dependent way, the delivery of this bundle lowers death, ventilator days, and readmissions to critical care, delirium, coma, and discharge to facilities. **(Engel et al., 2022)**.

Over the past few decades, the clinical approach to treating critically ill patients has undergone a significant shift from deep sedation to mobilizing patients on mechanical ventilation and limiting sedation. The ICU Liberation Bundle is an evidence-based, multidisciplinary approach to the holistic management of critically ill patients that strives to maximize patient recovery and minimize hospitalization-related stressors. **(Mart et al., 2019).**

The ICU liberation bundle can be used to decrease readmissions, delirium coma, invasive mechanical ventilation (IMV) days, sedation dosage, physical constraint, and ICU admission and hospital stays. It can also increase survival. While there is evidence that the ICU liberation bundle improves the previously listed patient outcomes, putting these methods into clinical practice is difficult and varies depending on the country. **(FradeMera et al ., 2022).**

Significance of the study:

Critical illness is a-life threatening multisystem process that can result in

Significant morbidity or mortality in most patients. According to reports, delirium affects patients in intensive care units at a rate of 40–87%. It is most common in older persons and those on mechanical ventilation, and it is linked to worse clinical outcomes (such as longer hospital stays). The ICU liberation bundle highlights the necessity for developing of an appropriate approach to enhance delirium assessment, prevention, and management. **(Ryan et al., 2021).**

So, implementing ABCDEF bundle is very important and positive for the critically ill patients and it depends on the patients' length of stay. Interventions that reduce ICU and improve recovery after critical illness **(Asim et al., 2020)**. The ICU liberation bundle it should be identified as part of the routine, clinical Practice because recent studies have confirmed that the beneficial effects of an ICU liberation bundle.

Aim of the study:

To investigate the effect of implementation ICU liberation bundle on critically ill patients outcomes.

Research hypotheses

- Patients who received ICU liberation bundle would be less prone to ICU-acquired weakness than that of control group.
- Critically ill patients who received ICU liberation bundle would have shorter durations of mechanical ventilator use, decreased ICU stay and hospital lengths of stay than those receiving usual care.

Patients and Method

Research Design:-

A quasi-experimental study research design was used in the current study.

Setting:

The study was carried at the intensive care unit (ICU) (trauma, general, and anesthesia) of the main Asyut University Hospital. This is the teaching hospital in Asyut. The unit treats patients who are critically ill in all categories, including those who have cardiac, respiratory, and trauma conditions.

Sample:

A convenience sample of sixty patients admitted to ICU. They were divided equally into two matched groups; control and study (30 patients each).

Sample Size:

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

$$n = \frac{300 \times (1.96)^2 \times (0.221)^2}{(1.96)^2 \times (0.221)^2 + 300 \times (0.05)^2} = 60$$

Where:

$Z = 1.96[\text{standard scores}]$,

$e = 0.05[\text{error}]$,

$\sigma = 0.221[SD]$

$N = 300[\text{population}]$,

$\underline{\mathbf{n = 60[sample]}}$

The patients' inclusion criteria:

- Both sexes with age from 20-60 years, critically ill patient with MV. Critically ill patient diagnosed with multiple organ dysfunction syndromes. Sepsis and septic shock.
- **Exclusion criteria**: Patient with spinal cord injury and Immune diseases.

Tools of data collection:

Data were collected using four tools in order to achieve the aim of this study.

Tool 1: patient assessment sheet:

The researcher developed this tool to assess the critically ill patients in the intensive care unit based on relevant literature **(Gyawali et al., 2019)**.

Part 1: Socio-demographic data:

Covered three main section: the first one is related to background data such as: patient's age, sex, The second one cover clinical data such as vital signs , hemodynamic state (arterial blood gases),diagnosis , duration of ICU stay ,past medical diseases , past surgical history. Part Three include: mode of parameter ventilation and duration of mechanical ventilation.

Part 2: Assessment Pain for **Behavioral Pain Scale (BPS)** The BPS included three main parts of face status, movement of upper limb, and Compliance with ventilation adopted by **(Payen, et al., 2001)** This scale ranks pain from 3 to 12, and the patient's status based on this scale is painless (3), mild (4–6), moderate (7–9), or severe (10–12) pain..

Tool 2: Assessing muscle strength of Medical Research Council (MRC) Scale adapted by **(DaSilva et al., 2022)** the total score for scale is 60This scale ranging from Grade 0 (no visible contraction) Grade 1: visible contraction without movement of the limb (not existent for hip flexion)

Grade 2: Movement of the limb but not against gravity .Grade 3: Movement against gravity over (almost) the full range. Grade 4: Movement against gravity and resistance. Grade 5: Normal in six muscle in upper and lower body.

Tool 3: Family Engagement Assessment Sheet for Numeric Rating Scale (NRS) adopted by **(Abd El Wareth et al., 2019)** This tool was used in assessing level of family engagement ranging **0–2** represents no family involvement or presence; **3–5** represents family empowerment and engagement just beginning; **6–8** represents family engagement, open visiting, and the beginning of family participation in medical rounds; and **9–10** represents daily family involvement in medical rounds.).

Tool 4: Patients' outcomes assessment sheet:

Designing sheet to study the expected Patients' outcomes of applying ICU liberation bundle for patients with multiple organ dysfunction syndromes. Such as: Shorten the duration of mechanical ventilation, decreased ICU-acquired weakness, ICU mortality and improvement ICU patient and family involvement in care processes.

Methods

The study was conducted through 3phases:

Preparation phase, implementation phase &evaluation phase.

Phase of preparation:

The researcher reviewed relevant literature and created study tools. Following an explanation of the purpose and design of the study, the intensive care unit (ICU) management committee first granted permission for the study to be carried out in the designated unit.

Validity and Reliability of tools:

Tools of the study were tested for content validity by five jury experts. Three professors of critical care nursing staff at faculty of nursing, Assuit University and two professors of anesthesia and intensive care medicine faculty of medicine, Assuit University and modifications were done. Internal consistency was assessed by using Cronbach alpha test and it reached (0.86, 0.85) for study tools.

Pilot study:

Was conducted on 10% of the study patients 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.

Ethical considerations:

Research proposal approved from Ethical Committee With date 21/9/2022 and number 1120240445 in the Faculty of Nursing Assiut Universty, there was no risk for study subject during application of the research, and the study followed common ethical principles in clinical research.

Written consent obtained from patients or guidance that were willing to participate in the study after explaining the nature and purpose of the study, Patient assured that the data of this research not be refused without a second permission, Patients had the right to refuse to participate and \or withdraw from the study\ without any rationale at any time and Confidentiality and anonymity assured.

Implementation phase for both groups:

In this stage, the researcher recorded the patient's demographics and baseline clinical data from his or her sheet while also evaluating the patient starting on the first day of the ICU stay.

The control group:

Standard care the Individuals receiving normal medical, nursing, and allied healthcare were assigned to the control group. Daily decisions without the use of protocols comprise standard care: pain management; spontaneous breathing and awakening trials as decided by the on-duty consultant intensive visit; once or twice daily passive and active exercise as decided by the day's physiotherapist with patients usually staying in bed if they are ventilated. **(Sosnowski et al., 2018).**

The study group:

Study group was received routine hospital care & ICU liberation bundle. This bundle is designed to be completed at least from patient admission until patient discharge.

Description of ICU liberation bundle:

The bundle ABCDEF consists of: measure, avoid, and control Pain, Including spontaneous breathing Trials (SBT) and spontaneous awakening trials (SAT), optional sedation and analgesia, delirium: evaluate, avoid, and treat, early movement and exercise, and empowerment of the family.

Part A: Assess, Prevent and manage Pain: Prior to delivering pain relief, pain must first be assessed. In cases of severe pain, pain medication should be taken on a regular basis. However, non-pharmacological approaches, such as injury stabilization, patient repositioning, and the application of heat or cold, are frequently safe and effective alternatives. **(Jones 2023).**

Part B:The synchronization of both the spontaneous awakening trials (SAT) and the spontaneous breathing trials (SBT), which emphasize narcotic and sedation titration leading to an earlier release from mechanical ventilation, intensive care unit, and hospitalization, is one of the fundamental components of the ABCDEF bundle.**(Balas et al , 2019).**

Part C: Guidelines for choosing analgesia and sedation place a strong emphasis on the necessity of goal-directed psychoactive medication delivery in order to prevent over sedation, encourage early extubation, and assist the medical team in reaching a

consensus on a target sedation level through the use of sedation scales. **(Balzer et al, 2015).**

Part D: Assessing, avoiding, and managing delirium although a number of techniques have been developed and proven effective in diagnosing delirium in intensive care unit (ICU) patients, the confusion assessment method for the intensive care unit (CAM-ICU) is the most often used instrument for this purpose. Make sure that delirium patients receive adequate communication, reorientation (e.g., by outlining their whereabouts, identity, and your job), and reassurance. To assist with this, think about including caregivers, friends, and family. Establish a setting that is appropriate for care. **(Tantawy & Abd-Elaziz , 2018).**

Part E: Early mobility is a crucial component of the ABCDEF bundle and the only intervention that has been shown to reduce the number of delirium days experienced by patients. There is strong evidence to support the strategy of reducing sedation and encouraging ICU patients to be physically active to the point of getting out of bed. **(Kress & Hall 2014).**

Part F: Involvement of the family since no ICU treatment plan is complete without taking into account the family's wishes, concerns, questions, and participation, the ABCDE approach has evolved to include family engagement. It is imperative that family members and surrogate decision makers participate actively in multidisciplinary decision-making and treatment planning. **(Soleimani et al, 2024).**

Steps of implementation the ICU liberation bundle

Element A: Recording of at least one pain assessment every day in the morning by using a valid and reliable instrument Behavioral Pain Scale.

Element B: Was subdivided into: • B1 (Spontaneous Awakening Trials) is the recording of at least one sedation interruption trial, at start of day shift to perform and record SAT safety screen. • B2 (Spontaneous Breathing Trials) is the recording of at least one spontaneous breathing trial. After perform and record SAT.

Element C: Recording of at least one assessment of agitation-sedation using a valid and reliable instrument (i.e., Richmond Agitation Sedation Scale.

Element D: Recording of at least one delirium assessment using a valid and reliable instrument per shift (e.g., the Confusion Assessment Method for the ICU.

Element E: Recording of at least one early mobilization modality (e.g., passive bed mobility, active bed mobility, sitting at the edge of the bed, standing, walking, transferring to a chair, tilt-table according patient ability.

Element F: Recording of at least one of the following activities performed with a family member/caregiver who has been educated or participated in rounds, lectures, care plans, or bundle-related care.

Evaluation phase:

This stage involved analyzing the study patients' outcomes in light of their clinical data in order to determine the impact of the ICU bundle application on lowering mechanical ventilation complications. Shorten the length of hospital stay and reduce the length of time spent on mechanical ventilation. **(Da Silva 2019)**

Statistical analysis

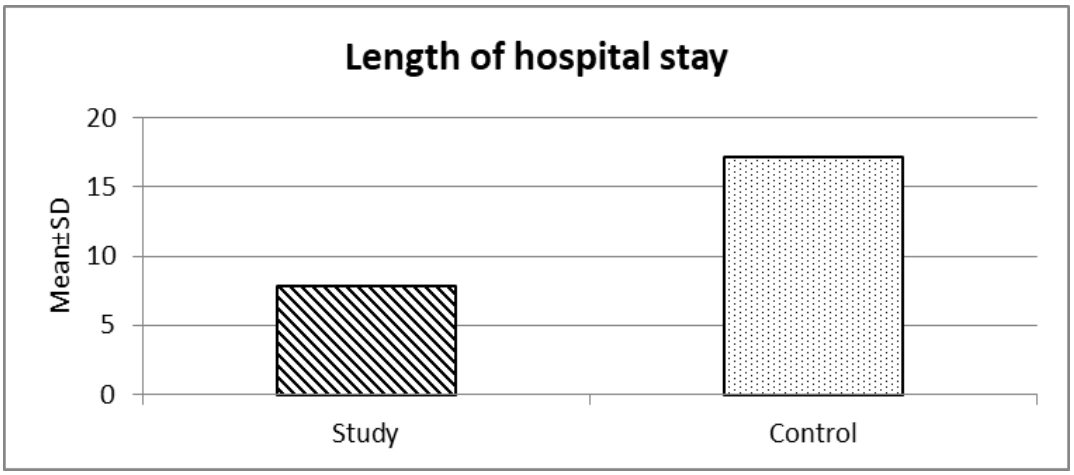
Data analysis was carried out using IBM SPSS V.27. Demographic and clinical characteristics were described using **frequency and percentage** (N, %) for nominal or ordinal level data while **mean and standard deviation** (Mean, SD) were used to describe interval level data. To test the significance of the difference between study and control groups regarding their frequency distribution according to given demographic characteristic, the **Chi-square test of goodness of fit** was used. **Two independent samples T-test** was used to test the significance of the difference in the mean of a given outcome between the study and control samples while **two independent samples proportion test** was used to test the significance of the difference in the proportion of occurrence of a given outcome between the study and control samples.

Results

Table (1): Demographic and clinical characteristics for study and control groups (N=60)

Variable	Study(n=30)		Control(n=30)		P-value
	No.	%	No.	%	
age groups					
Less than 40 years	11	36.7	7	23.3	0.084
More than 40 years	19	63.3	23	76.7	
Mean ± SD	44.17 ± 11.36		51.30 ± 13.39		0.030 *
Gender					
Female	14	46.7	10	33.3	0.121
Male	16	53.3	20	66.7	
Diagnosis					
Angina	2	13.33	2	6.67	0.064
Acute respiratory distress syndrome	3	16.67	2	6.67	
Motor car accident	5	10.00	2	6.67	
Pneumonia	5	6.67	5	16.67	
post traumatic injury	1	23.33	2	6.67	
Shocked	3	6.67	7	23.33	
Subdural hemorrhage	1	13.33	3	10.00	
Other	10	10.00	7	23.33	
Past medical history					
Angina	3	10.00	5	16.67	<0.001
Diabetes mellitus	13	43.33	5	16.67	
Hypertension	7	23.33	11	36.67	
None	1	3.33	6	20.00	
Other	6	20.00	3	10.00	
Past surgical history					
Appendectomy	16	53.33	15	50.00	0.335
Appendicitis	2	6.67	1	3.33	
Cholecystectomy	1	3.33	3	10.00	
None	9	30.00	9	30.00	
Other	2	6.67	2	6.67	
Duration of mechanical ventilation	1.63±0.96		8.58±3.82		<0.001 **

** Significant Difference* *** Highly Significant Difference*



Chi-square test statistically- independent t-test ** Significant difference at p. value <0.001*

Fig (1): Total Mean Scores for Length of hospital stay of patients (N=60)

Table (2): Mean ± SD of Hemodynamic Parameters in Study and Control groups (N=60)

Variable	Study(n=30)	Control(n=30)	P-value
On Admission			
Temp	37.19 ± 0.59	37.37 ± 0.62	0.269
Pulse	97.73 ± 14.95	96.53 ± 13.81	0.748
Respiratory Rate	18.57 ± 6.07	19.23 ± 7.55	0.710
Systolic Blood Pressure	108.47 ± 25.11	109.27 ± 18.44	0.889
Diastolic Blood Pressure	70.17 ± 12.90	69.47 ± 17.31	0.860
2nd Day			
Temp	37.65 ± 0.80	37.40 ± 0.95	0.275
Pulse	96.40 ± 14.42	96.67 ± 12.17	0.938
Respiratory Rate	18.13 ± 5.33	19.00 ± 7.44	0.798
Systolic Blood Pressure	115.63 ± 19.97	114.13 ± 21.09	0.778
Diastolic Blood Pressure	74 ± 10.37	73.33 ± 11.55	0.815
3rd Day			
Temp	36.95 ± 0.89	37.18 ± 0.33	0.186
Pulse	90.23 ± 11.35	96.17 ± 11.30	0.047 *
Respiratory Rate	16.57 ± 5.02	19.13 ± 4.68	0.046 *
Systolic Blood Pressure	115.07 ± 21.92	115.33 ± 18.33	0.959
Diastolic Blood Pressure	77 ± 8.37	73.67 ± 11.89	0.214
4th Day			
Temp	36.94 ± 0.96	37.24 ± 0.32	0.108
Pulse	87.43 ± 11.50	93.23 ± 9.30	0.036 *
Respiratory Rate	16.03 ± 4.69	18.93 ± 5.32	0.029 *
Systolic Blood Pressure	120 ± 6.43	118.83 ± 11.27	0.624
Diastolic Blood Pressure	80.33 ± 6.69	77.33 ± 9.44	0.161
5th Day			
Temp	37.08 ± 0.19	37.18 ± 0.33	0.159
Pulse	83.47 ± 11.23	90.53 ± 12.90	0.028 *
Respiratory Rate	15.07 ± 4.92	18.80 ± 5.42	0.007 **
Systolic Blood Pressure	125.67 ± 13.88	119.83 ± 11.78	0.085
Diastolic Blood Pressure	80.33 ± 7.18	78 ± 10.31	0.313
6th Day			
Temp	37.03 ± 0.13	37.08 ± 0.27	0.356
Pulse	79.37 ± 10.91	88.53 ± 11.56	0.003 **
Respiratory Rate	14.13 ± 3.55	17.67 ± 5.40	0.004 **
Systolic Blood Pressure	121.90 ± 8.67	118.20 ± 7.92	0.090
Diastolic Blood Pressure	80.60 ± 8.37	76.93 ± 12.29	0.182

** Significant Difference* *** Highly Significant Difference*

Table (3): Significance of the difference in arterial blood gases measures in study and control groups (N=60)

Variable	Study(n=30)	Control (n=30)	P-value
On Admission			
PH	8.32±5.7	7.28±0.1	0.321
Po2	80.24±13.12	79.33±11.36	0.775
PaCo2	42.25±10.98	40.45±10.34	0.514
Hco3	30.32±32.83	21.07±5.15	0.133
Sao2	90.26±10.3	89.2±13.64	0.735
BE	-1.53±5.06	-4.08±6.31	0.090
2nd Day			
PH	8.37±5.69	7.29±0.07	0.304
Po2	81.52±12.85	80.13±10.53	0.648
PaCo2	38.74±10.89	38.64±9.8	0.972
Hco3	22.47±5.9	22.66±5.94	0.901
Sao2	91.63±11.73	88.83±12.04	0.365
BE	-2.51±6.65	-5.14±5.38	0.097

Variable	Study(n=30)	Control (n=30)	P-value
3rd Day			
PH	7.34±0.11	7.33±0.11	0.780
Po2	84.50±8.02	80.35±7.85	0.047 *
PaCo2	38.67±13.67	33.54±9.45	0.097
Hco3	21.73±4.14	20.93±4.06	0.453
Sao2	93.62±10.03	88.38±10.17	0.049 *
BE	-3.56±5.87	-5.01±5.6	0.330
4th Day			
PH	7.35±0.08	7.34±0.09	0.739
Po2	86.47±9.30	81.35±9.61	0.040 *
PaCo2	36.78±8.64	33.02±6.28	0.058
Hco3	22.66±3.79	22.27±4.2	0.707
Sao2	95.60±9.24	89.90±10.83	0.032 *
BE	-3.11±4.09	-4.99±4.32	0.088
5th Day			
PH	7.36±0.08	7.33±0.09	0.228
Po2	89.63±9.01	82.94±8.56	0.005 **
PaCo2	38.24±10.26	36.87±7.86	0.563
Hco3	22.97±3.8	23.17±4.08	0.845
Sao2	97.07±10.53	90.13±9.93	0.011 *
BE	-3.36±5.15	-4.3±4.82	0.468
6th Day			
PH	7.3±0.55	7.35±0.08	0.595
Po2	90.87±9.18	83.42±6.29	<0.001 **
PaCo2	37.65±10.65	39.07±8.94	0.578
Hco3	22.88±3.76	23.6±4.56	0.509
Sao2	99.2±7.58	91.27±8.38	<0.001 **
BE	-3.13±4.37	-4.03±4.96	0.457

** Significant Difference* *** Highly Significant Difference*

Table (4): Modes of ventilation in study and control groups (N=60)

Variable	Study(n=30)	Control(n=30)	P-value
On Admission			
MV	0.800±0.073	0.767±0.077	0.754
Simple face mask	0±0	0±0	.a
T-piece with venture	0.200±0.073	0.233±0.077	0.754
On room air	0±0	0±0	.a
2nd Day			
MV	0.833±0.068	0.733±0.081	0.347
Simple face mask	0±0	0±0	.a
T-piece with venture	0.167±0.068	0.267±0.081	0.347
On room air	0±0	0±0	.a
3rd Day			
MV	0.700±0.084	0.800±0.073	0.371
Simple face mask	0	0	.a
T-piece with venture	0.300±0.084	0.200±0.073	0.371
On room air	0	0	.a
4th Day			
MV	0.500±0.091	0.767±0.077	0.032 *
Simple face mask	0	0	.a
T-piece with venture	0.500±0.091	0.233±0.077	0.032 *
On room air	0	0	.a

Variable	Study(n=30)	Control(n=30)	P-value
5th Day			
MV	0	0.700±0.084	<0.001 **
Simple face mask	0.700±0.084	0	<0.001 **
T-piece with venture	0.300±0.084	0.300±0.084	1.000
On room air	0	0	.a
6th Day			
MV	0	0.700±0.084	<0.001 **
Simple face mask	0.700±0.084	0	<0.001 **
T-piece with venture	0.200±0.073	0.300±0.084	0.371
On room air	0.133±0.062	0	0.038 *

** Significant Difference ** Highly Significant Difference .a p-value can't be calculated*

Table (5): Pain Score assessment between study and control groups (N=60)

Variable	Study(n=30)	Control(n=30)	P-value
On Admission	8.27 ±1.72	8.73±1.62	0.291
2nd Day	7.61±1.41	8.24 ±1.52	0.101
3rd Day	6.50±1.73	7.60±1.62	0.014 *
4th Day	4.83±1.58	7.12±1.65	<0.001 **
5th Day	2.43±1.76	6.43±1.50	<0.001 **
6th Day	1.17±1.63	5.40±1.43	<0.001 **

*** Highly Significant Difference*

Table (6): Muscle Strength Level between Study and Control Groups (N=60)

Variable	Study(n=30)	Control(n=30)	P-value
On Admission	25.98±6.05	27.87±7.20	0.430
2nd Day	26.63±6.31	28.33±7.30	0.339
3rd Day	32.40±5.26	28.74±7.05	0.026 *
4th Day	36.13±7.80	29.53±7.45	0.001 **
5th Day	42.53±8.28	33.20±7.70	<0.001 **
6th Day	49.70±8.10	34.47±8.48	<0.001 **

*** Highly Significant Difference*

Table (7): Family Engagement Level in Study and Control Groups (N=60)

Variable	Study(n=30)	Control(n=30)	P-value
On Admission	2.07±1.20	2.17±1.46	0.773
2nd Day	3.17±1.36	2.83±1.29	0.325
3rd Day	4.20±1.48	3.24±1.55	0.017 *
4th Day	6.02±1.30	3.80±1.07	<0.001 **
5th Day	8.37±1.34	4.27±1.05	<0.001 **
6th Day	9.13±0.94	4.93±1.25	<0.001 **

*** Highly Significant Difference*

Table (8): Frequency distributions of mortality, ICU acquired weakness, and delirium for study and control groups (N=60)

Variable	Study(n=30)		Control (n=30)		P value
	No.	%	No.	%	
Mortality					
No	27	90	23	76.7	0.084
Yes	3	10	7	23.3	
ICU acquired weakness					

No	29	96.7	1	3.3	<0.001 **
Yes	1	3.3	29	96.7	
Delirium					
No	30	100	6	20	<0.001 **
Yes	0	0	24	80	

Table (1): Revealed that the two third of the studied groups were male, Regarding to age the majority of sample age of patients more than 40 years with mean age (44.17±11.36, 51.30±13.39) in study and control group. In addition, the table illustrated the higher mean of duration of mechanical ventilation (8.58±3.82) in control group.

Fig (1): Shows that the mean length of hospital stays for the study group (7.83±1.29) is significantly less than for the control group (17.10±4.46).

Table (2): Clarifies the hemodynamic parameters the mean values of five parameters of homodynamic state in 6 days of hospital stay. On the 6th day, the mean pulse and respiratory rate 79.37 ± 10.91 and 14.13 ± 3.55 respectively for the study group while they were 88.53 ± 11.56 and 17.67 ± 5.40 for the control group.

Table (3): Represents the significance regarding the mean values of six arterial blood gases in 6 days of hospital stay. On the 6th day, the mean Po2 and Sao2 were 90.87±9.18 and 99.2±7.58 respectively for the study group while they were 83.42±6.29and 91.27±8.38 for the control group.

Table (4): Illustrates the significance of the difference between the experimental and control groups about the proportion of using five methods of patient ventilation in 6 days of hospital stay. On the 4th day the proportion of using MV for the study group (0.500±0.091) compared to control group (0.767±0.077) while the proportion of using T-piece with venture for the study group (0.500±0.091) was significantly higher than it was for the control group. On the 6th day the proportion of using MV for the study group (0) was significantly less than it was for the control group (0.700±0.084) while the proportion of using simple face mask for the study group (0.700±0.084).

Table (5): Shows the significance the mean pain score in 6 days of hospital stay. From the 3rd day till the 6th day, the mean pain score for the control group was higher than study group, on the 6th day the mean pain score was 1.17±1.63 for the study group while it was 5.40±1.43 for the control group with statistically significant differences presented by p value 0.001.

Table (6): Represents the significance of the mean muscle strength level. It was discovered that the study group with care bundle implementation had a significantly the mean muscle strength level was 49.70±8.10 on the 6th day compared with 34.47±8.48 for the control group.

Table (7): Demonstrates the importance of the variation in the mean level of family engagement between the study and control groups. The mean degree of family engagement for the study group was substantially higher than that of the control group from the third to the sixth day. The study group's mean level of family engagement on day six was 9.13±0.94, compared to 4.93±1.25 for the control group.

Table (8): Represents the frequency distributions of mortality, ICU acquired weakness, and delirium for study and control groups. Only 10% of the study sample reported dead whereas less than one quarter (23.3%) of the control sample reported dead. Only (3.3%) of the study sample had ICU acquired weakness whilst the vast majority of the control sample (96.7%) had acquired weakness. None of the study sample (0%) had delirium while four fifths (80%) of the control sample had delirium**.**

Discussion

ABCDE bundle implementation are standardized techniques based on differing levels of evidence that when used together, produce better results than used separately. It includes essential techniques including: assess, management and prevent pain ,An interprofessional, evidence-based, multicomponent ICU management strategy that aims to decrease sedation exposure, the length of time patients spend on mechanical ventilation, the incidence of ICU-acquired weakness and the awakening and breathing coordination, delirium monitoring/management, and early exercise/mobility (ABCDE) bundle. The therapies that make up the ABCDE bundle have been demonstrated in several carefully planned clinical trials to enhance the outcomes of critically ill patients. **(Kram et al, 2015**).

Regarding background information and medical data:

The current study's findings showed that there was no statistically significant difference between the two groups' distributions with regard to the following at admission: age, gender, marital status, diagnosis, and previous surgical history. There were sixty patients in the study sample, with thirty patients in each group. The study patients' (control and study) mean age was (44.17±11.36&51.30±13.39) respectively, with a statistically significant difference between the two

groups. Regarding gender, the majority of research group participants were older than 40 years old, with over half of them being male. This result supported with **(Hill et al, 2020)**. Who reported that many men are at high risk for admitted to intensive care unit with differential diagnosis as shock, ARDS, trauma and other, Also study by **(Todorov et al, 2021).**They found that men make up roughly two thirds of patients admitted to the critical care unit, and that this difference can be explained by the potential immunological effects of sex hormones and health state. When comparing the married patients to the single patients in both categories, it was discovered that the majority of the patients were married. This result agrees with **(Li et al, 2022).**who stated that 7% of participants were single and more than one thirty of participants were married. It was noted that the patient's past medical history, diagnosis, and surgical history did not significantly affect the ICU. The current investigation showed that over one-third of the sample in both the study and control groups reported having diabetes mellitus. Hypertension (23.33%and36.67%) respectively, this result in line with **(Apaydin et al, 2022)**Who reported that about (9.1% and 33.3%) respectively had history of diabetes mellitus and(18.2% and66.7% respectively) had history of hypertension .

Regarding the duration of hospital stays

The results of the current study showed that the length of patients' stays in the intensive care unit was positively impacted by the ICU release bundle. Patients in the on ICU liberation bundle stayed shorter than those in the control group. Patients in the intensive care unit were handled in a similar manner. The average duration of hospital stays (7.83±1.29) is considerably less than the average duration of hospital stays (17.10±4.46) for the participants in the non- ICU release bundle group who were treated exclusively with regular care in the intensive care unit. The research group subject's shorter stay might be ascribed to the ICU liberation bundle, which enabled enhanced care delivery while minimizing hospital stays by identifying and addressing medical issues early on, providing nursing or other issues requiring for an extended stay in the hospital. A reduced length of stay (LOS) in the intensive care unit (ICU) could have been caused by these reasons. Additionally, the current study's conclusions concur with the findings of the six research they are looking at how the intensive care unit bundle affects the duration of stay **(Gunther et al, 2021).** Four investigations revealed that the ICU bundle group had a noticeably lower length of stay (LOS).Overall; these studies' findings demonstrated that ICU bundles have a beneficial impact on hospital stay duration.

Arterial blood gases (ABG):

An essential component of evaluating patients who are critically sick is the examination of arterial blood gases. It enables quick testing in close proximity to the patient. Providing crucial details about tissue hypoxia, ventilation, oxygenation, and metabolic state. The **(Alarcan et al, 2023)** Concerning arterial blood gases (ABG), the current study showed that, in comparison to subjects in the control group, patients in the ICU liberation bundle group had a gradually improving mean value of pao2. This study found that, with regard to arterial oxygen saturation (Sao2), the non- ICU liberation bundle group's mean value of Sao2 decreased from admission to six days, while the ICU liberation bundle group's mean value increased. The use of the ICU liberation bundle produced this beneficial outcome. Research by **(Nanjayya et al, 2020)** who mentioned that the mean value of pao2 was relatively improved among patients in the ICU liberation bundle.

Regarding the patient ventilation techniques:

Mechanical ventilation is currently the most used kind of life support for critically sick patients, despite the fact that it comes with a number of financial and clinical risks. Hospital-acquired infections rank second in terms of the most common sickness affecting ventilated patients. These infections have higher rates of morbidity, mortality, and length of stay (ranging from 4 to 13 days). As soon as it is practicable, patients should be weaned off of ventilators to avoid problems associated with mechanical ventilation. **(Haribhai & Mahboobi, 2022)** The result of study showed the patient ventilation techniques improved among patients in ICU liberation bundle group subjects rather than control group subjects. For dependent on mechanical ventilation the study reported that the using T-piece, simple face mask and room air for the ICU liberation bundle group subjects improved from admission to six day than non ICU liberation bundle group. This positive effect resulted from application of ICU liberation bundle specially SAT & SBT. Study by **(Na et al , 2022)** who mentioned that the effective of the weaning was performed using T-piece was relatively improve patients in the ICU liberation bundle for the patients who met the criteria for readiness to wean. There former studies reported that the T-piece was associated with shorter mechanical ventilation length **(Thille et al , 2022).**

In relation to pain score:

Pain is a major source of stress for patients in the intensive care unit (ICU). It can be brought on by underlying medical conditions, surgeries, and treatments such mechanical ventilation, tracheal suctioning, and peripheral blood draws. In the intensive care unit, opioids are the primary treatment

for severe postoperative pain; nonetheless, pain persists even when these pharmaceutical agents are regularly used. The Society of Critical Care Medicine's (SCCM) clinical practice guidelines recommended the use of complementary nonpharmacological interventions, like massage, to maximize pain relief in the intensive care unit (ICU). These interventions have the potential to enhance analgesia and minimize the amount of opioids administered According to **(El-Tallawy et al, 2023)**. Findings of our present study show that the ICU bundle used in pain management such as (pharmacological, music, cold therapy, topical heat therapy and massage) effective to reduce severity of pain in patients in critical condition. This outcome is consistent with a related study carried out by **(Yarahmadi et al , 2018).**who demonstrated that patients' discomfort following the removal of their chest tubes may be decreased with music therapy; however, in this trial, music therapy was coupled with cold therapy ($p < 0.001$). The study's findings concur with those of a Canadian study (**Boitor et al , 2018**).This was revealed to the person who discovered that patients can lessen mean pain and lower pain severity after receiving massage therapy during heart surgery for about 20 minutes. Reducing discomfort and anxiety by an average of two points on a scale from 0 to 10 for each intervention session.

As regarding to Muscle Strength Level:

A typical issue for critically ill patients admitted to the intensive care unit (ICU) is atrophy and muscle weakness. In extreme situations, muscle weakness can result in tetraplegia, diminished or absent tendon reflexes, a delayed transition off of artificial breathing, physical impairment, and a higher risk of death. The severely sick patients admitted to intensive care units saw improvements in muscle strength as a result of early mobility, an exercise regimen, and massage therapy. As evidenced by the p-values of 0.001, the study group with an ICU liberation bundle had a mean muscle strength level that was significantly/highly higher than that of the control group without an ICU liberation bundle. The current study's findings are consistent with those of **(Anekwe et al , 2020)**, who shown through a comprehensive review and meta-analysis that early rehabilitation was linked to a lower risk of developing ICU-AW.These findings are consistent with those of **(Rahiminezhad et al , 2022)**. Your study's findings indicated that massage and range-of-motion exercises could significantly impact the muscle strength of patients admitted to intensive care units. Conclusions drawn from the analysis of (**Sarfati et al , 2018)** results did not align with the findings of the current investigation because in the type of intervention and the study setting.

In concern to family engagement:

According to this study, the study group's mean degree of family engagement was much higher than that of the control group. These results are supported by research by **(Abd ElWareth & Elcokany 2019)**; the investigator point of view family members must be engaged in the plan of care and implementation of any services to their patients. This demonstrates that bringing family members into the ICU could be an effective non-pharmacological management strategy for patients on mechanical ventilation in particular. This strategy could shorten the duration of the patient's stay in the ICU by reducing delirium and improving weaning outcomes. Regarding the advantages of family engagement, this result is consistent with the American Society of Critical Care Medicine's report on the application of the ABCDEF bundle's F element, which states that family involvement reduces confusion, agitation, and anxiety and, as a result, shortens ICU stays. Additionally, it raises sentiments of safety and patient pleasure.it increases feelings of security; patient satisfaction thus improves quality of care **(Ely 2017).**

In relation to Patient Outcome with ICU liberation bundle:

Mechanical ventilation day.

The current result shows the relation between the studied patients'& mechanical ventilation days. This result may be due to implement the ICU bundle. Mechanical ventilation days for the study group less than in the control group. This finding supported by **(Mohamed et al., 2023)** who reported that the mean of ICU stay and MV duration was lower in study group. This could relate to the improvement in oxygenation achieved post implementation of ventilator care bundle, resulting in speedy recovery and discharge. Additionally this finding aligns with the research conducted by **(Pun et al, 2019)**, which examined the care of critically ill patients using the ABCDEF bundle. This finding, however, was at odds with a study conducted in Africa by **(Khalil et al , 2018)**, which examined patients' weaning off of mechanical ventilation and compared the use of complete versus incomplete ventilator care bundles. That study concluded that there was no statistically significant relationship between the ventilator care bundle and weaning off of mechanical ventilation.

Regarding relation between the studied patients' and ICU mortality:

The mean ICU mortality percentage for the study group (8.75±10.7) was highly significantly less than it was for the control group (23.53±9.12) with p-value <0.001. This result concurs with the research conducted by **(El-Hosseini et al, 2022)**. who conducted research on the efficiency of using a bundle of care to wean patients on mechanical

ventilation in cardiac and critical care units. The probability of in-ICU mortality the following day was shown to be reduced when the full bundle compliance was revealed on a particular day (0.8% compliant vs. 1.2% noncompliant). And this outcome is consistent with research by **(Umemura et al., 2022).** Who investigated if adherence to the Hour-1 bundle was linked to a decrease in in-hospital mortality in sepsis patients.

Relation between the studied patients' and ICU acquired weakness:

The finding of study revealed to the proportion of ICU acquired weakness for the study group (0.033±0.033) was highly significantly less than it was for the control group (0.967±0.033) the researcher think the result due to implement the early mobility from ICU bundle. This result in same line with study by **(de Souza et al, 2022).**Who studied the efficiency of a quality-improvement plan using a particular visual aid to encourage early ICU mobilization This study mentions that a safe way to lessen ICU-acquired weakness (ICU-AW), which can directly impact functional status, is through early progressive mobilization, which is represented as the "E" bundle component.

In concern the relation between the studied patients' and ICU delirium: Delirium may occur in as many as 60–80% of mechanically ventilated patients, it is associated with increased a multitude of adverse outcomes .The proportion of delirium in study subject was (0) when compared to control group (0.8±0.073) with p-value <0.001.The finding may be due to implement pharmacological and non-pharmacological assess, management and prevent delirium bundle. The present study is in line with the study done by **(Mohamed et al , 2023)** who reported that after Ventilator Care Bundle implementation that patients of bundle(intervention group) had a significantly shorter ICU stay, lower VAP, and a reduce rate of delirium while the control group had higher mortality, incidence of DVT, and pulmonary embolism .These findings are paralleled with those of **(Malik et al , 2021)** that implementation of delirium bundle led to an insignificant reduction in the incidence of new-onset delirium. There was a trend toward a reduction in the number of days with delirium and duration of mechanical ventilation.

The frequency distributions of mortality:

The finding of study show only 10% of the study sample reported dead whereas less than one quarter (23.3%) of the control sample reported dead. The rate of death reduced result implementation of ICU bundle .this result confirm with study by **(Wang et al , 2020)** who studied care packages in addition to comprehensive nursing care for septic shock patients in the ICU: mortality and nursing satisfaction. The primary discovery of this investigation A total of 5 deaths, or a 12.5% mortality rate, were reported in the control group, while no death records were found in the experimental group. Compared to the control group, the experimental group's mortality rate was noticeably lower.

From the investigator point of view, The ABCDEF bundle represents one method of approaching the organizational changes that create a culture shift in the treatment of ICU patients. The multifold potential benefits of these recommended strategies outweigh minimal risks of costs and coordination. Ultimately, the ABCDEF bundle is one path to well-rounded patient care and optimal resource utilization resulting in more interactive ICU patients with better pain control, who can safely participate with their families and health care providers in higher-order physical and cognitive activities at the earliest point in their critical illness.

Conclusion

Although bundle interventions are beneficial in reducing the proportion of patient hospital LOS and mortality in ICU patients, the present study's findings support the effects of bundle interventions on reducing the prevalence and shortening the duration of ICU delirium.

Recommendations

Based on finding of this study, incorporate Implementation of ABCDE bundle care principles into routine clinical practice. These include of translating global standards into regional tongues, an increased emphasis on interprofessional education and interdisciplinary treatment in the ICU, focus on patient survival to draw attention to long-term patient outcomes and future studies are needed to test the implementation and compliance of ABCDE approach care by nurses.

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