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Effects of ABCDE Bundle Implementation on Reduction of Delirium among Mechanically Ventilated Patients at Damietta Hospital, Egypt

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Abstract

Background: One of the principal complications in intensive care unit particularly those connected to mechanical ventilation is delirium. Delirium. It is associated with increased mortality, prolonged mechanical ventilation, and prolonged hospital length of stay (LOS). The ABCDE is a bundle intervention that stands for awakening, breathing coordination, delirium monitoring/management, and early exercise/mobility bundle that has been proposed as a multi-component intervention to reduce the incidence of delirium.

Aim of the study: This study aimed to evaluate the effect of implementing the ABCDE bundle on the reduction of delirium among mechanically ventilated patients at Damietta hospital.

Material and Methods: A quasi-experimental pre/post-intervention design was used to conduct this study. A purposive sample of 65 adult male and female mechanically ventilated patients aged between 18 and 60 years was recruited. Sedation and Delirium instruments measures were utilized in data collection.

Result: significant differences were found in delirium scores among the studied patients ($\chi^2 = 52.52$; $p\text{-value} = 0.001$). So, the mechanically ventilated patients who exposed to the implementation of the ABCDE bundle were experienced fewer delirium signs than before the ABCDE bundle implementation.

Conclusion: Based on the findings of the current study, it can be concluded ABCDE bundle implementation reduced the occurrence of delirium among mechanically ventilated patients.

Recommendations: ABCDE bundle should be recommended on mechanically ventilated patients.

Keywords: ABCDE bundle; Mechanically Ventilated Patients; Critically Ill Patients

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Introduction

Delirium is a frequent and serious problem in the intensive care unit (ICU). It is common in the early stages of hospitalization for a variety of acute and chronic diseases [1]. Delirium in ICU affects 60 to 80% of patients receiving mechanical ventilation and 20 to 50% of patients who are not receiving mechanical ventilation [2]. It is associated with increased mortality, prolonged mechanical ventilation, and prolonged hospital length of stay (LOS) [3]. Moreover, its consequences can be prevented by proper assessment, diagnosis and management [4]. Delirium is a dysfunction that occurs due to various pathophysiological factors such as the inflammatory reaction of the brain to injury, hormonal affection, and alterations in neurotransmission connections [5]. It's categorized into three subtypes: hyperactive, hypoactive, and mixed type. Hyperactive delirium is characterized by aggression, agitation delusion, hallucination, and psychomotor hyperactivity. Hypoactive delirious patients may show decreased attention, lethargy, slowed psychomotor activities and reduced responsiveness. Patients with mixed type delirium fluctuate between hyperactive and hypoactive delirium [6]. The Society of Critical Care Medicine for the management of pain, agitation, and delirium (SCCM PAD) guidelines 2013, in adult patients in the ICU, described bundle of interventions to be adopted in the care of patients connected to mechanical a ventilator is known as "ABCDE" that involve awakening, breathing trial coordination with suitable sedation, management of delirium, and early mobility [7]. The ABCDE bundle principally depends upon three rules improving interaction health team members in critical care settings, providing standard care, and decreasing connection to mechanical ventilation and over sedation that result in delirium [8]. ABCDE bundle is a group of practices that based on evidence-based guidelines when practices totally have

been verified to promote patient outcomes. Those bundles are utilized in critical care units. The use of bundles may be similarly beneficial for developing patient-centered protocols for preventing and treating PAD in critically ill patients [6].

The aim of the study

The aim of the study is to evaluate the effect of implementing the ABCDE bundle on the reduction of delirium into everyday practice for mechanically ventilated patients at Damietta hospital in Egypt.

Research hypothesis

Mechanically ventilated patients who are exposed to the implementation of the ABCDE bundle will experience fewer delirium signs than those who received routine care.

Research design

A quasi-experimental research design was chosen to demonstrate causality between intervention and outcome. It is an experimental study used to appraise the causal- effect of an experiment on the population without randomization. It permits the researcher to control the intervention or experimentation but utilizing some norms other than randomization. In some cases, the researcher may have control over an assignment to treatment [9-10].

Setting

This study was conducted in the intensive care units at Damietta Chest Disease Hospital.

Subjects

A purposive sample of 65 adult male and female mechanically ventilated patients aged between 18 and 60 years were included. The exclusion criteria included



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Patients with congestive heart failure, sepsis, prolonged restraints and immobility, seizures, and head trauma [11-12].

Sample Size Calculation

With alpha error 5% and study power 80% with the expected incidence of delirium in the intervention arm=40% and 80% in the non-intervention arm, then the sample size = 60 in each group. Add 10% (5 cases for each group to compensate for defaulters) then the final sample size = 65 in pre-intervention and post-intervention groups.

Tools of data collection

Instrument 1: patients' demographic & Health Relevant Data.

This tool was developed by the researcher; it included patient's demographic data (name, age, gender, diagnosis, and date of admission, past medical history, level of consciousness, mobility status, medications, analgesics, and sedation).

Instrument 2: Sedation assessment (Riker Sedation-Agitation Scale (SAS)).

That instrument was selected from [13]. It was utilized to evaluate levels of sedation. The first scale that proven to be valid and reliable in critically ill patients was Riker Sedation Agitation Scale. It consists of seven points, (7) Dangerous Agitation, (6) Very Agitated, (5) Agitated, (4) Calm and Cooperative, (3) Sedated, (2) Very Sedated, and (1) Unarousable. It is carried out every 4 hours after patient's connection to mechanical ventilator and persists for three days in both groups.

Tool III: Delirium assessment (Intensive Care Delirium Screening Checklist (ICDSC)).

The researcher assessed the delirium in patients by using the Intensive Care Delirium Screening Checklist (ICDSC). It was selected from [14], to evaluate the conscious level, disorientation, agitation, inattention, speaking/Affect and mood disturbances, disturbances of sleep, and hallucinations. The researcher utilized this checklist every 12 hours after awakening of the patient and recurred for three days before and after executing of the ABCDE bundle. The ICDSC involves 8 items, each item was scored as absent or present (0 or 1) and summed, A score (≥ 4) denotes (delirium), while (0-3) denotes (no delirium).

Validity and Reliability of the instruments

The instruments were examined for face and content validity by 5 experts in the Critical Care and Emergency Nursing field, and Intensive Care Medicine at Mansoura and Cairo Universities. A reliability test was applied by the researcher for testing the internal consistency of the developed instrument; the Delirium Screening Checklist. The reliability was 0.876.

The procedure of Data collection

Permission to implement the study was taken from the hospital research committee after an explanation of nature and purpose of the study. The patients or their families were contacted to explain the nature and purpose of the study. Later, written approval form was taken from them if patients were unconscious. After that, the researcher collected the patients' demographic & health-relevant data. Later, the researcher evaluated the patient's sedation level utilizing Riker Sedation-Agitation Scale (SAS). Finally, the researcher assessed the delirium status by utilizing the delirium screening checklist. The researcher assessed sedation level by using the Riker Sedation-Agitation Scale through observing the patient's consciousness and recorded the results, if the

patient awoke and able to follow three or four simple commands, or was agitated, the researcher informed the respiratory therapist and initiate to wean the patient from the mechanical ventilation, but if the patient unarousable or much sedated, the researcher continued sedatives under medical supervision and re-assed the patient in the next 24 hours. When the patient achieved a score (3-4) in the Riker Sedation Agitation Scale (SAS), and able to follow three or four simple commands, the researcher informed the respiratory therapist and started to liberate the patient from the mechanical ventilator through (wake up and breath protocol).

Implementation of ABCDE bundle

Awakening and Breathing Coordination Trials (ABCs)

It was adopted from Girard, et al [15]. This protocol included Awakening and Breathing Coordination Trials (ABCs). The researcher was responsible for performing Spontaneous Awakening Trials (SATs), and the Respiratory Therapist was responsible for performing the Spontaneous Breathing Trials (SBTs) for every mechanically ventilated patient by determining if patient is prepared to breathe spontaneously. (Wake UP and Breathe Protocol).

Early Mobility Protocol

This protocol was selected from Pohlman, et al, [16]. It encouraged the initiation of early mobility and increase ambulation of patients. The physical therapist and the researcher applied this protocol at least once per day and lasted for three days. That protocol contained four levels of activity. The level one was a passive range of motion that was carried out by the mobility team nursing assistants. Active resistance exercises were initiated in the second level and later; the patient was being put upright three times a day. Movement of patient is gradually increased in the levels three and four

ranging from sitting on the edge of the bed to actively transferring to out of the bed.

Results

Table 1: illustrates patients' demographic and health Relevant data. It revealed that almost two-thirds of the patients aged 50 to 59 years old, and two-thirds of them were male. Regarding the past medical history, 24.62% of the patients were suffering from COPD, and 15.38% were diagnosed with renal failure. Moreover, in relation to the level of consciousness and mobility status, most of the patients (86.15%) were conscious and nearly two-thirds of them (64.62%) were mobile. Regarding the use of sedatives and opioids, nearly half (53.85%) of patients received sedatives, while Opioids were used by one-third (30.77%). Moreover, 15.38% were using antipsychotic drugs.



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Table 1: Patients' demographic and health relevant data.			
Variables	No.	%	Mean \pmSD
Age (years)			
≤ 20 years	2	3.08%	12.50 \pm 16.26
21-29 years	1	1.54%	25
30-39 years	5	7.69%	10.20 \pm 6.61
40-49 years	7	10.77%	17.00 \pm 10.98
50-59 years	40	61.54%	37.80 \pm 16.39
≥ 60 years	10	15.38%	37.30 \pm 20.77
Mean \pmSD	41.64\pm0.97		
Gender			
Male	39	60.00%	
Female	26	40.00%	
Past History			
Respiratory			
COPD	16	24.62%	
RF	10	15.38%	
Cardiac			
MI	8	12.31%	
IHD	5	7.69%	
AF	3	4.62%	
Others			
Myasthenia. Gravis	2	3.08%	
Carcinoma	4	6.15%	
Stroke	8	12.31%	
Hepatic	5	7.69%	
Renal	4	6.15%	
Level of consciousness			
Conscious	56	86.15%	
Unconscious	9	13.85%	
Mobility status			
Mobile	42	64.62%	
Immobile	7	10.77%	
Need assistance	16	24.62%	
Medication			
Opioids	20	30.77%	
Sedatives	35	53.85%	
Antipsychotic drugs	10	15.38%	



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Table 2: Distribution of patient's response utilizing Riker Sedation-Agitation Scale (SAS).								
Patient's Behavior According to SAS Score	1 st Day		2 nd Day		3 rd Day		Chi-square	
	No.	%	No.	%	No.	%	c ²	P-Value
Unarousable	1	1.54	4	6.15	4	6.15	89.57	0.001*
Very sedated	7	10.77	1	1.54	2	3.08		
Sedated	49	75.38	32	49.23	5	7.69		
Calm and cooperative	5	7.69	27	41.54	54	83.08		
Agitated	1	1.54	1	1.54	-	-		
Very agitated	2	3.08	-	-	-	-		
Mean ±SD	3.06 ±0.77		3.31 ±0.81		3.68 ±0.81			

***Significance at P level ≤0.05.**

Table (2) shows patients' response in Riker Sedation-Agitation Scale (SAS) evaluation. It revealed significant differences in patients' Riker Sedation -Agitation responses ($\chi^2 = 89.57$; $P = 0.001$). So; most of the patients (83.08%) showed calm and cooperative behavior on the third day when compared to other days. On the other hand, three fourth (75.38%) showed sedation on the first day.

Table 3: Frequency distribution of the incidence of delirium among the studied subjects after the intervention through three days.

Days	Incidence of Delirium	ICDSC Score #	No.	%	Chi-square		ANOVA	
					c ²	P-Value	F	P-Value
1 st Day	No	2	1	1.54	92.77	0.001*	5	0.001
		3	35	53.85				
		Total	36	55.38				
	Yes	4	12	18.46				
		5	1	1.54				
		6	3	4.62				
		7	7	10.77				
		8	6	9.23				
		Total	29	44.62				
Mean ±SD 4.23±1.80								
2 nd Day	No	2	3	4.62	88.51	0.001*		
		3	38	58.46				
		Total	41	63.08				
	Yes	4	12	18.46				
		5	7	10.77				
		6	4	6.15				
		7	1	1.54				
		Total	24	36.92				
		Mean ±SD 3.60±1.06						
3 rd Day	No	2	14	21.54	16.75	0.001*		
		3	35	53.85				
		Total	49	75.38				
	Yes	4	2	3.08				
		5	4	6.15				
		6	7	10.77				
		7	3	4.62				
		Total	16	24.62				
		Mean ±SD= 3.45±1.43						

Table 3: shows the distribution incidence of delirium among the studied patients after the intervention through three days. It revealed that nearly half (55.38%) of the patients hadn't any signs of delirium on the first day. This ratio was changed to better on the second day that revealed (63.08%) of patients were sub-syndromal delirium. On the other hand, on the third day, nearly three fourth of patients (75.38%) had no signs of delirium. As well, a significant statistical difference among the means delirium scores in the three days. So, the delirium scores decrease on the second day compared to the first and third day.

Table 4: Comparison of mean delirium scores by their gender.							
Time	Sex	N	Mean	SD	T-test		
					T	DF	P-value
1 st day	Male	39	4.27	1.9	1.4	63	0.889
	Female	26	4.19	1.67			
2 nd day	Male	30	3.56	1.14	0.333	63	0.74
	Female	35	3.65	0.94			
3 rd day	Male	45	3.41	1.33	0.747	63	0.806
	Female	20	3.5	1.58			
As can be seen from (Table 4), there is no significant differences among patients' incidence of delirium by their gender through three days.							

Table 5: Correlation between patients' age and delirium.			
Variable	Mean \pm SD	Correlation coefficient	
		R	P-value
Age	56.80 \pm 3.526	0.32*	0.017
Delirium	3.64 \pm 1.56		
As can be seen from table 6 that age is positively correlated with the incidence of delirium. (R=0.32).			

Table 6: Comparison of mean delirium scores by their current disease.			
Disease	No.	%	Delirium
			Mean \pm SD
COPD	16	24.62%	3.81 \pm 1.80
RF	10	15.38%	3.60 \pm 1.51
MI	8	12.31%	3.38 \pm 1.41
Stroke	8	12.31%	3.13 \pm 1.25
F=0.381; P=0.767			
It's apparent from (table 6) that no significant differences were found among patients' delirium scores by their current diseases.			

Discussion

The present study aimed to evaluate the effect of implementing the ABCDE bundle on the reduction of delirium among mechanically ventilated patients at Damietta hospital in Egypt. The current study showed that nearly two-thirds of the patients their age ranged between 50 to 59 years old, male, and had delirium. The possible explanation for this finding may have relevant to a decreased level of acetylcholine. So, acetylcholine is one of the great neurotransmitters that decreases with age and causing the incidence of delirium in the old age persons, and anticholinergic agents prone to

become worse the symptoms of delirium. This finding is matched with Kim, et al, [17] who investigated the frequent risk factors of delirium among a susceptible group of patients to delirium. The following studies done by [18-19] who revealed that age and male gender as the great demographic risk factors for inducing delirium for medical and surgical patients in various clinical settings. As well; Dessap, et al, [20-21] who studied incidence of both delirium and coma in Japanese ICU patients who is connected to mechanical ventilation agreed with the fact that older age associated with delirium. On the other hand, the current findings contradicted with Branco, et al, [22] who



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examined young patients with trauma who were injured in road accidents with the mean age of 37 years old and found that there was a mainly young individuals, age was remaining an essential variable for the occurrence of delirium. Concerning to mobility status of studied patients; our study showed that two-thirds of patients were mobile. This phenomenon helped in the implementation of early mobility in the ABCDE bundle and shortened the time spent in patients' connection to a mechanical ventilator. As a result, it decreased the occurrence of delirium and increased the initiation of early ambulation intervention [23-24]. This study finding is in line with [25] who recommended the early ambulation to make the patient become better and safe. Regarding the medications being administered, the current study revealed that more than half of patients received sedatives. On the other hand, patients who received opioids were less than one-third of the studied patients. So, these drugs have a harmful effect and are considered risk factors for the incidence of delirium [26]. These results are in line with [27,28]. Fraser, et al, [27-28] who found that the administering benzodiazepines such as midazolam for ICU patients accelerate the appearance of delirium, spending longer ICU stay, and more dependence on the mechanical ventilator. On the other hand, these findings are not matched with Seraphim, et al, [29] who analysed the utilization of dexmedetomidine and propofol in place of benzodiazepines to calm and relax patients, that resulted in decreased length of ICU stay and MV duration. Moreover, the current study showed that more than one-tenth of the studied patients received antipsychotic drugs. The same findings are agreed with the American Association of Critical-Care Nurses (AACN) [30] who declared that all patients who received antipsychotics such as; haloperidol or any of the atypical antipsychotics may develop delirium and recommended that these patients should be routinely and systematically monitored for side effects. As well, [31] mentioned that the harms

of delirium can be reduced in surgical hospitalized patients by utilizing administration of antipsychotic drugs. Though, the use of antipsychotic drugs did not cause an overt effect on the duration of delirium and length of hospital stay. On the other hand, [32] stated that utilization of psychotropic agents in critically ill patients without a particular diagnosis might increase the length of hospital stay. Concerning the assessment of patients' sedation and agitation utilizing the Riker Sedation Agitation Scale before and after ABCDE implementation in three days, the study findings revealed that more than three-quarters of patients were sedated on the 1st day compared to the majority of patients who were very calm and cooperative on the third day. This finding may have relevant to the recommendation of sedating patients' and alleviating their pain to prevent ICU delirium [33-34]. This intervention resulted in a decreased a requirement for utilizing restraining appliances, allowed for an early mobilization leading to improved patient condition. Furthermore, it decreased the expenditures concerned with the prevention and management of delirium. Similarly, these findings are agreed with Morando, et al, [7] who confirmed a strong association between delirium and exposure to sedatives. On the other hand, [35] added that critical care nurses can't able to recognize delirium frequently in their patients due to inappropriate utilization of sedation which leading to longer ICU and hospital stays, increased mortality, and long-standing cognitive impairments [36]. As well, the present finding is congruent with another study carried out by [37] who studied sedation in patients with delirium and found a deeper level of sedation in delirious patients than those without delirium and also after sedation interruption. This finding illustrated a fact that sedative drugs can remain in the body for a long time in critically ill patients. Moreover, a Persistent Delirium was appeared to be at a deeper level of sedation at their 2-hour assessment than those with rapidly reversible delirium (RRD). So, heavy sedation played an



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essential role in causing negative consequences seen in these patients. On the other hand, this finding is not agreed with [38] who detected that patients not only persisted to remain moderately sedated for up to 2 hours though the withdrawing of sedative drugs but those at a deeper sedation level developed an increased occurrence of delirium, disregarding the screening instrument of delirium being utilized. However, 20% and 32% of the patients in their study administered continuous and intermittent sedative medications with midazolam, respectively, which may have been accountable for the deferred awakening trials. Moreover, Riker, et al, [39] who mentioned that dexmedetomidine was associated with the onset of delirium but with fewer neurocognitive disorders than propofol. On the other hand, [40] have detected that sedation by dexmedetomidine versus propofol maintained or even improved cognitive function in patients with decreased baseline cognition. The current finding was agreed with [41,36,23] who implemented the bundle protocol of ABCDE found that implementation decreased the incidence of delirium from 62.3% to 48.7%, as well as the length of mechanical ventilation connection. Summarily, Bounds, et al, [2] who investigated the effect of implementation of ABCDE bundle on the prevalence of delirium in intensive care unit patients and found that the ABCDE implementation decreased the prevalence of delirium significantly from two fifths to one fifth and the mean number of days of delirium decreased from three days to one day. As well, this finding is consistent with Lee, et al, [42] who carried out the study in patients in post-cardiac surgery and found decreased incidence of delirium after heart surgery among intervention group of patients when compared to the control group that did not receive it. On the other hand, Colombo, et al, [43] carried a study in medical- surgical critical care units where patients were called by their names, was informed about hospitalization location and the progress of their condition. That study detected these practices were regarded to be safe and

protective towards the incidence of delirium and helped in preventing delirium. Concerning the correlation of delirium with their demographic characteristics. The current study found a positive correlation between patients' age, and the incidence of delirium, which approved that patient who ages between 50 to 59 years, had a higher incidence of delirium as it was a risk factor for delirium American Geriatrics Society Expert Panel on Postoperative Delirium in Older Adults, [44]. These results agreed with Tomasi, et al, [3] who found that patients with a diagnosis of delirium were older. Also, Hosie, et al, [45] who studied delirium in palliative care settings found that delirium is prevalent among old age patients especially male patient Hagerling, et al, [46-47] but contrasted with our study that showed that there was no correlation found between patients' gender and incidence of delirium. Also, Chu, et al, [48] who examined the occurrence of postoperative delirium in old age patients who underwent orthopaedic surgery found that delirium incidence was higher in male patients and stated the gender of male is a risk factor for delirium. On the other hand, this finding is not agreed with Atay, et al, [49] who studied delirium prevalence, risk factors, and cognitive functions in elderly hip fracture cases under general and spinal anaesthesia and found no significant correlation between delirium and gender. Moreover, our study finding revealed that nearly half of chronic obstructive pulmonary disease (COPD) patients had a higher incidence of delirium. This finding may have relevant to systemic inflammation and blood-oxygenation disorders and they are considered as a risk factor for delirium Toloache, et al, [50]. This finding is consistent with Austin, et al, [51] who studied the missing links of systemic inflammation and oxidative stress in the relation between COPD and incidence of delirium.

Conclusion

Based on the findings of the present study, there was a significant improvement of delirium after a successful implementation of the elements of the ABCDE bundle that included spontaneous awakening trials (SAT), spontaneous breathing trials (SBT), coordination of SAT and SBT, careful selection of sedative, delirium assessment and prevention, and early mobility.

Recommendations

Implementation of ABCDE bundle among mechanically ventilated patients

Limitation of the Study

The sample was selected from one hospital in the Arab Republic of Egypt that restricts the generalization of findings.

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