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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 (x2= 52.52; p-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: It can be concluded ABCDE bundle implementation reduced the occurrence of delirium among mechanically ventilated patients.

Recommendations: ABCDE bundle should be implemented in mechanically ventilated patients.

Keywords

ABCDE bundle; Mechanically ventilated patients; Critically Ill Patients

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 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 tool was adopted from [13]**.** It was used to assess sedation levels. Riker Sedation Agitation Scale (SAS) was the first scale proven to be reliable and valid in critically ill adults. SAS scores a patient's level of consciousness and agitation from 7 points list describing patient behavior. (SAS Target Sedation = 3 to 4). Riker Sedation Agitation Scale (SAS) contains 7 points, (7) Dangerous Agitation, (6) Very Agitated, (5)

Agitated, (4) Calm and Cooperative, (3) Sedated, (2) Very Sedated, (1) Unarousable, it is used every 4 hours after the patient's connection to mechanical ventilation and lasts for three days for both groups.

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

The researcher assessed the patient's delirium status by using the Intensive Care Delirium Screening Checklist (ICDSC). It was adopted from [14], to assess the level of consciousness, inattention, disorientation, hallucinations, psychomotor agitation, speech/ mood disturbance, sleep disturbance, and fluctuation of symptoms. The researcher used this tool every 12 hours after the patient waked up and lasted for three days before and after implementation of the ABCDE bundle. The ICDSC contains 8 items, each item is scored as absent or present (0 or **1)** and summed, A score (>4**)** indicates (delirium), while (0-3) indicates (no delirium).

Validity and Reliability of the instruments

The tools were tested for content-related validity by a panel of 5 experts in the Critical Care and Emergency Nursing Department, and Intensive Care Medicine Department 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 conduct the study was obtained from the hospital research committee after an explanation of the aim and nature of the study. The patients or their families were contacted to explain the nature and purpose of the study. Then, informed consent was obtained from them in case of unconscious patients. 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 using the Intensive Care Delirium Screening Checklist (ICDSC).

The researcher assessed sedation level by using the Riker Sedation-Agitation Scale trough 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 [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 a mechanically ventilated patient is ready to breathe on his\her own through.(Wake UP and Breathe Protocol).

Early mobility protocol

This protocol was selected from [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. This protocol had four levels of activity. The first level of activity was a passive range of motion performed by the mobility team nursing assistants. Active resistance exercises' were initiated in the second level and later; the patient was being placed in the upright position three times daily. Activity gradually increased in the third and fourth levels from sitting on the edge of the bed and then actively transferring to a chair 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.

Variables	No.	%	Mean ±SD
Age (years)			
≤ 20 years	2	3.08%	12.50±16.26
21-29 years	1	1.54%	25
30-39 years	5	7.69%	10.20±6.61
40-49 years	7	10.77%	17.00±10.98
50-59 years	40	61.54%	37.80±16.39
≥ 60 years	10	15.38%	37.30±20.77
Mean ±SD	**41.64±0.97**		
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%

Table 1: patients' demographic and health relevant data.

Patient's behavior according to SAS Score	1st Day		2nd Day		3rd Day		Chi-square	
	No.	%	No.	%	No.	%	c^2	P-Value
Unarousable	1	1.54	4	6.15	4	6.15	89.57	.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: Distribution of patient's response utilizing Riker Sedation-Agitation Scale (SAS).

(Table 2) shows patients' response in Riker Sedation-Agitation Scale (SAS) evaluation. It revealed significant differences in patients' Riker Sedation -Agitation responses (x2= 89.57; P= .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) illustrates the incidence of delirium in the studied patients before intervention. It showed that most patients were delirious (87.69%).

Incidence of Delirium	ICDSC Score			Chi-square	
		N	%	χ^2	P-Value
No	3	8	12.31	**36.94**	**0.001***
	Total	**8**	**12.31**		
Yes	4	10	15.38		
	5	25	38.46		
	6	12	18.46		
	7	7	10.77		
	8	3	4.62		
	Total	**57**	**87.69**		
Mean ±SD pre	**3.76±1.35**				

Table 3: Frequency distribution of the incidence of delirium among the studied subjects Before ABCDE implementation

(Table 4) 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.

Days	Incidence of Delirium	ICDSC Score #	No.	%	Chi-square		ANOVA	
					χ^2	P-Value	F	P-Value
1st 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**				
2nd 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**				
3rd 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 4: Frequency distribution of the incidence of delirium among the studied subjects after the intervention through three days.

As can be seen from (Table 5), there is no significant differences among patients' incidence of delirium by their gender through three days.

Time	Sex	N	Mean	SD	T-test		
					T	DF	P-value
1st day	Male	39	4.27	1.9	1.4	63	0.889
	Female	26	4.19	1.67			
2nd day	Male	30	3.56	1.14	0.333	63	0.74
	Female	35	3.65	0.94			
3rd day	Male	45	3.41	1.33	0.747	63	0.806
	Female	20	3.5	1.58			

Table 5: Comparison of mean delirium scores by their gender.

As can be seen from (Table 6) that age is positively correlated with the incidence of delirium. (R=0.32)**.**

Variable	Mean ±SD	Correlation coefficient	
		r	P-value
Age	56.80±3.526	0.32*	0.017
Delirium	3.64±1.56		

Table 6: Correlation between patients' age and delirium.

It's apparent from (Table 7) that no significant differences were found among patients' delirium scores by their current diseases

Disease	No.	%	Delirium
			Mean±SD
COPD	16	24.62%	3.81±1.80
RF	10	15.38%	3.60±1.51
MI	8	12.31%	3.38±1.41
Stroke	8	12.31%	3.13±1.25
			F=0.381; P=0.767

Table 7: Comparison of mean delirium scores by their current disease.

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 major neurotransmitters involved in Reticular Activating System (RAS) function that declines with age and triggering the occurrence of delirium in the elderly, and anticholinergic agents tend to worsen the symptoms of delirium. This study finding is consistent with [17]. Who studied the major risk factors of delirium among a vulnerable group of patients to delirium.

The following studies [18-19] who revealed that age and male gender as the major demographic risk factors for the development of delirium across a wide range of clinical settings for medical and surgical patients. As well, [20-21] who studied Delirium and coma in mechanically ventilated patients in the intensive care unit in Japan agreed with the fact that older age was associated with delirium. On the other hand, the current findings were in contrast with [22] who studied young patients with trauma who were victims of road accidents and urban violence with the mean age of 37 years old and found that there was a predominantly young population, age was still a determining factor for the incidence 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 incidence of delirium and increased the rate of early ambulatory mobilization practice [23-24]**.** This study finding is agreed with [25] who recommended the early mobilization of critically ill patients at the earliest time to improve patient safety.

Regarding the medications being administered**,** the **c**urrent 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 medications have a detrimental effect and are risk factors for the occurrence of delirium [26]**.** These results are in line with (27, 28) who showed that the use of benzodiazepines like midazolam for critically ill patients favors the emergence of delirium, longer ICU stay, and more dependence on the mechanical ventilator.

On the other hand, these findings are not matched with [29] who analyzed the use of dexmedetomidine and propofol instead of benzodiazepines to sedate patients, which reduced the 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] determined that the risk of delirium can be lowered in surgical inpatients by the preventive use of antipsychotic drugs. However, the use of antipsychotic medications did not result in a remarkable effect on the length of delirium and duration of hospital stay. On the other side, [32] stated that utilization of psychotropic agents in critically ill patients without a specific diagnosis might increase the duration of hospital stay and mortality.

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 the use of sedatives and early relief of pain to improve ICU delirium [33-34]. This practice was led to a decreased need for using mechanical restraint devices, allowed for an early initiation of mobility contributing to better clinical conditions of patients. Moreover, it reduced costs related to therapy and the prevention of delirium. Similarly, these findings are agreed with [7] who confirmed a strong association between delirium and exposure to sedatives.

On the other hand, [35] added that critical care clinicians frequently fail to recognize delirium in their patients due to improper use of sedation which resulting in longer ICU and hospital stays, an increase in mortality, and long-term cognitive impairments [36]. As well, the current finding is consistent with another study done 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 clarified a fact that sedatives can persist in the body for a significant duration in critically ill patients. Moreover, a Persistent Delirium was found to be at a deeper level of sedation at their 2-hour assessment than those with Rapidly Reversible Delirium (RRD). So, over sedation played a significant role in the negative outcomes seen in this population.

On the other hand, this finding is incongruent with [38] who demonstrated that patients were not only continued \to remain moderately sedated for up to 2 hours despite the removal of sedative medications but those at a deeper level of sedation had an increased incidence of delirium, irrespective of the delirium screening instrument used. However, 20% and 32% of the patients in their study received continuous and intermittent sedation with midazolam, respectively, which may have been responsible for the delayed awakening trials.

Moreover, [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 found that dexmedetomidine sedation in contrast to propofol preserved or even improved cognitive function in patients with decreased baseline cognition. The current finding was consistent with [41, 36, 23] who applied the ABCDE bundle protocol and found that implementation of the bundle reduced the delirium from 62.3% to 48.7%, as well as the length of stay on mechanical ventilation.

Summarily, [2] who studied the effect of ABCDE bundle implementation on the prevalence of delirium in intensive care unit patients found that implementation of the ABCDE bundle 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 [42] who carried out the study in patients in post-cardiac surgery through care delivered by nurses and their staff and found results preventing delirium among patients in post-cardiac surgery in the intervention group and the occurrence of delirium was lower in comparison with the group that did not receive it. On the other hand, [43] who carried a study in a medical and surgical ICU where patients were called by the first

names, informed about the place of hospitalization and the development of their clinical condition, found that these interventions were considered to be protective against the occurrence of delirium. It is worth noticing that these are simple interventions that help in preventing delirium and that nurses should appraise and use these interventions in nursing care and encourage the staff to do it.

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 [44]. These results agreed with [3] who found that patients with a diagnosis of delirium were older. Also, [45] who studied delirium in palliative care settings found that delirium is prevalent among old age patients especially male patient [46-47] but contrasted with our study that showed that there was no correlation found between patients' gender and incidence of delirium.

Also, [48] who studied the development of postoperative delirium in elderly patients undergoing orthopedic surgery found that delirium incidence is higher in male patients and mentioned that male gender is a risk factor for delirium. On the other hand, this finding is not agreed with [49] who studied delirium prevalence, risk factors, and cognitive functions in elderly hip fracture cases under general and spinal anesthesia and found no significant association between gender and delirium.

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 [50]. This finding is consistent with [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 drawn from one hospital in one geographical area in the Arab Republic of Egypt that restricts the generalization of findings. Patients with Congestive heart failure, sepsis, prolonged restraint use and immobility, withdrawal seizures, head trauma, and intracranial space-occupying lesions will be excluded from this study.

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