
Critical care nurses' practices in implementing the "ABCDE bundle" among mechanically ventilated patients: Review of Literature

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Abstract

The current review of literature covered the following sections; Prevalence of delirium, Nurses assessment of delirium, and management approaches to decrease delirium among mechanically ventilated patients such as ABCDE bundle.

The American Psychiatric Association's (APA) of Mental Disorders (DSM), defined delirium as a sudden onset and fluctuating course of inattention, disturbed level of consciousness and cognition, hallucination or delusion. Symptoms may accompany with sleep, emotional disturbances, and abnormal psychomotor activity (American Psychiatric Association, 2013).

Introduction

In the Intensive Care Unit (ICU) patients, **the prevalence of delirium** was 32.3%, in other ICU, it may be higher. Other research showed the prevalence of delirium as high as 77% in ventilated burn patients. The incidence of delirium in the ICU ranged from 45% to 87%, this percentage appeared to be different to the studied population who composed exclusively to mechanically ventilated patients. Another study showed that 20% of non-intubated ICU patients, whereas another study found that the incidence of delirium in mechanically ventilated patients was 83% (Salluh et al., 2010).

Delirium categorized into three subtypes: hyperactive, hypoactive, and mixed type. **Hyperactive Delirium** is characterized by agitation, aggressive behavior, and psychomotor hyperactivity. Those patients put themselves or others at danger for injury because of their distorted thought process and resultant behaviors. Psychotic features such as hallucinations, delusions and paranoia may be found (Kim, & Hong, 2015). Patients with type II of **Delirium** have decreased awareness or lethargy due to decreased activity. It is often referred to a quiet delirium that regularly goes undiagnosed and underestimated when there is no active monitoring with validated clinical tool; it is also the most prevalent, happening in more than 60% of patient (Sole, et al., 2013).

In Intensive Care Unit (ICU) **assessing delirium** patients can be difficult because of endotracheal intubation, using of sedatives, endotracheal tube and complexity of delirium diagnosis tools. Without a screening tool, most cases are missed by ICU physicians and ICU nurses. Because

of these barriers, some detective tools have been improved for diagnosis of delirium and medical staff trained well on its (Reade, Phil, & Finfer, 2014). **The American College of Critical Care Medicine (ACCM)** recommended that most patients in ICU should be tested for delirium at least once per each shift as less frequent screening or screening only on patient admission missed prognosis onset of delirium and evaluated for sedation level every (4-6) hours (Heeder, Azocar, & Tsai, 2015). There are two tools used to assess sedation level such as Richmond Agitation Sedation Scale (RASS), and Riker Sedation Agitation Scale (SAS).

There are variety of tools exist for the detection of delirium, but only the Confusion Assessment Method adapted for using in the ICU (CAM-ICU), Intensive Care Delirium Screening Checklist (ICDSC), Delirium Detection Score (DDS), Cognitive Test for Delirium (CTD), and the Neelon and Champagne Confusion Scale are considered to be valid in the ICU (Cavallazzi, Saad, & Marik, 2012; De, & Wand, 2015). Although the variety of these screening tools, the Intensive Care Delirium Screening Checklist (ICDSC) and the Confusion Assessment Method (CAM-ICU) have the higher validity and reliability for using in ICU (Reade, Phil, & Finfer, 2014; Gesin, Russell, Lin, Norton, Evans, & Devlin, 2012).

Both ICDSC and CAM-ICU have been validated as reliable tools for the diagnosis of delirium. As they are based upon the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria for delirium, so it assisted medical staff in ICU to detect delirium early and rapidly and it is modified for nonverbal and mechanically ventilated

patients (Heeder, Azocar, & Tsai, 2015). A difference between the scales is that the CAM-ICU assessment focused on specific point in time whereas the ICDSC assessment included information from the previous 24 hours (Urden, Stacy, & Lough, 2013).

The CAM-ICU, adapted from the Confusion Assessment Method, was designed for use in intubated patients and mechanically ventilated ICU patients. It's sensitivity from 93% to 100% and specificity from 89% to 100% for delirium (Jones&Pisani, 2012). When the CAM-ICU is used, delirium diagnosed rapidly in two steps see **Figure no (1A)**, patient's consciousness was firstly assessed when a valid sedation scale used as, Richmond Agitation-Sedation Scale (RASS) see **figure no (1B)** (Lopez, Aldecoa, & Rico, 2013).

The Sedation Scale of Richmond Agitation (RASS) considered as ten points scaled from (+4) to (-5), zero score meaning that the patient was calm and cooperative. Also, when RASS scored of (-4) or (-5), this meaning that the patient was comatose and can't be tested for delirium. The score of -3 showed that the Patient was moderately sedated; alert and should be assessed for delirium. The CAM-ICU used to assess patients for types and categories of delirium see **figure no (1B)** (Lopez, Aldecoa, & Rico, 2013).

The Intensive Care Delirium Screening Checklist (ICDSC) scored from zero to eight that had a higher sensitivity (99%) and specificity of 64% for detecting delirium. Because of its sensitivity, it is most recommended in ICU to detect delirium. When using the ICDSC, level of consciousness is the first rated on a 5-point scale that ranged from unresponsive to exaggerated response,

see **figure no (1C)** or through Riker Sedation Agitation Scale (SAS) which rated on 7 points that ranged from unarousable to dangerous agitation, see **figure (1D)**. All conscious patients should be assessed for delirium daily, (A or B on the ICDSC scale). The ICDSC consists of eight items (rated present or absent), and each patient who given a score from 0 to 8 and score equal 4 or greater is considered diagnostic for delirium (Lopez, Aldecoa, & Rico, 2013).

Riker Sedation Agitation Scale (SAS) was the first scale proven to be reliable and valid in critically ill adults. It scores a patient's level of consciousness and agitation from 7 points list describing patient behavior. SAS Target Sedation equal 3 to 4. SAS is a 7 points, (7) describe Dangerous Agitation, (6) means Very Agitated, (5) means Agitated, (4) Calm and Cooperative patients, (3) Sedated patients, (2) means Very Sedated, and (1) Unarousable.

The CAM-ICU had most sensitivity compared to the ICDSC. However, when it used daily, the CAM-ICU cannot detect most of the delirious patients. But the ICDSC had the ability to detect different types of delirium. The rate of ICU delirium depending on the type of screening tool which used (ICDSC or the CAM-ICU) and ranged between 16% and 45% with the ICDSC, and between 30% and 89% with the CAM-ICU (Burry, & Rose, 2015; Zaal, 2014; Luetz et al., 2010).

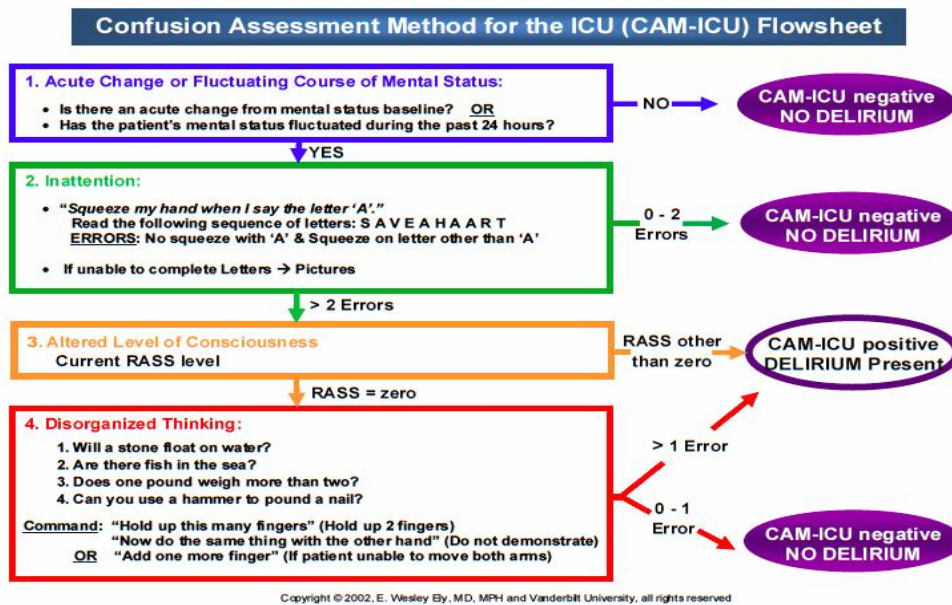


Figure (1A): Delirium Assessment (CAM-ICU) Algorithm Adopted from Barr et al., 2013

Richmond Agitation-Sedation Scale (RASS)

Score	State	Description
+ 4	Combative	Overtly combative, violent, immediate danger to staff
+ 3	Very agitated	Pulls or removes tube(s) or catheter(s); aggressive
+ 2	Agitated	Frequent non-purposeful movement, fights ventilator
+ 1	Restless	Anxious, but movements not aggressive or vigorous
0	Alert and calm	
-1	Drowsy	Not fully alert, but has sustained awakening (eye opening/eye contact) to <i>voice</i> (≥10 seconds)
-2	Light sedation	Briefly awakens with eye contact to <i>voice</i> (<10 seconds)
-3	Moderate sedation	Movement or eye opening to <i>voice</i> (but no eye contact)
-4	Deep sedation	No response to <i>voice</i> , but movement or eye opening to <i>physical stimulation</i>
-5	Unarousable	No response to <i>voice</i> or <i>physical stimulation</i>

Figure (1B): the Sedation Scale of Richmond-Agitation (RASS) Adopted from Barr et al., 2013

Intensive Care Delirium Screening Checklist (ICDSC)

<ul style="list-style-type: none"> Score your patient over the entire shift. Components don't all need to be present at the same time. Components #1 through #4 require a focused bedside patient assessment. This cannot be completed when the patient is deeply sedated or comatose (i.e., SAS = 1 or 2; RASS = -4 or -5). Components #5 through #8 are based on observations throughout the entire shift. Information from the prior 24 hours (i.e., from prior 1-2 nursing shifts) should be obtained for components #7 and #8. 			
1. Altered level of consciousness			
Deep sedation/coma over entire shift [SAS= 1, 2; RASS = -4,-5]	= Not assessable		
Agitation [SAS = 5, 6, or 7; RASS= 1-4] at any point	= 1 point	No	0 1 Yes
Normal wakefulness [SAS = 4; RASS = 0] over the entire shift	= 0 points		
Light sedation [SAS = 3; RASS= -1, -2, -3]	= 1 point (if no recent sedatives) = 0 points (if recent sedatives)		
2. Inattention			
Difficulty following instructions or conversation; easily distracted by external stimuli. Will not reliably squeeze hands to spoken letter "A": S A V E A H A A R T		No	0 1 Yes
3. Disorientation			
In addition to name, place, and date, does the patient recognize ICU caregivers? Does patient know what kind of place they are in? (List examples such as dentist's office, home, work, hospital.)		No	0 1 Yes
4. Hallucination, delusion, or psychosis			
Ask the patient if they are having hallucinations or delusions (e.g., trying to catch an object that isn't there). Are they afraid of the people or things around them?		No	0 1 Yes
5. Psychomotor agitation or retardation			
EITHER: Hyperactivity requiring the use of sedative drugs or restraints to control potentially dangerous behavior (e.g., pulling IV lines out or hitting staff). OR: Hypoactive or clinically noticeable psychomotor slowing or retardation.		No	0 1 Yes
6. Inappropriate speech or mood			
Patient displays inappropriate emotion, disorganized or incoherent speech, sexual or inappropriate interactions, or is apathetic or overly demanding.		No	0 1 Yes
7. Sleep-wake cycle disturbance			
EITHER: Frequent awakening/<4 hours sleep at night. OR: Sleeping during much of the day.		No	0 1 Yes
8. Symptom fluctuation			
Fluctuation of any of the above symptoms over a 24-hour period.		No	0 1 Yes
TOTAL SHIFT SCORE (Min 0 – Max 8)			

Interpretations:

Score 0: Normal Score 1-3: subsyndromal delirium Score 4-8: delirium

Figure (1C): Intensive care Delirium Screening Checklist (ICDSC)

Adopted from Barr et al., (2013)

Riker Sedation Agitation Scale (SAS)

7	Patient agitated	Agitation meaning: Pulling ET tube, trying to remove catheters, climbing over bedrail, and striking at staff.
6	Very Agitated	Very Agitated meaning: Requiring restraint and frequent verbal reminding of limits, or biting on ETT.
5	Agitated	Agitated, Anxious or physically agitated, and calms to verbal orders.
4	Calm and Cooperative	It's meaning, easily arousable, and follows commands.
3	Sedated	Shaking, follows simple commands but drifts off again.
2	Very Sedated	Responding to physical stimuli but cannot communicate or follow commands.
1	Unarousable	Minimal or no response to external stimuli, does not Communicate well or follow commands.

Table (1A): Riker Sedation Agitation Scale (SAS) Adopted from Barr et al., (2013)

Nurses role in implementing of ABCDE bundle on Reduction of Delirium among Mechanically Ventilated Patients.

To prevent delirium, the staff should follow ABCDE bundle, the ABCDE bundle meaning the following: the awakening and breathing coordination trials (ABCs), delirium monitoring, and early mobility application).It had been used to decrease ICU-acquired delirium and weakness, which is indicator for long period of mechanically ventilated patient's and long sedation in ICU. This approach proved the evidence-based strategies into daily clinical practice. This protocol based upon patients ability to success or fail trials for interruption of sedation, and delirium monitoring (Vasilevskis, Ely, Speroff, Pun, Boehm, &Dittus 2010).

Awakening trials accompanied with spontaneous breathing trials which ended by extubation, and patient's exercise. If any trials fail, the level of sedation decreased or titrated to the previous dose. After reassessment of sedation and delirium, reassessment is performed. This bundle approach may be a promising option in clinical practice for the management of critically ill

patients(Pandharipande, Banerjee, McGrane, &Ely, 2010).

The Society of Critical Care Medicine(SCCM PAD) guidelines2013,encouraged the initiation of early mobilization, promoting sleep by maintaining patients' environments safe, using strategies to control light and noise, decreasing patient care activities, and external stimuli especially at night(Barr et al., 2013). Also it did not suggest using of haloperidol or atypical antipsychotics drugs to prevent delirium in those patients, this is contraindicated with researches who recommended using of these drugs especially after cardiac surgery with cardiopulmonary bypass (Wang et al., 2012).

The ABCDE bundle can be applied well if an effective and proper communication used between medical staff in ICU team. The respiratory therapist, critical care nurse and physical therapist assessed patient sedation level, and gave patient trials for awakening and breathing (wake up and breath protocol) (Vasilevskis et al., 2010).The ABCDE bundlecomposed of some essential components that must be done effectively. See figure no (5) (Morandi, Brummel, &Ely, 2011).



**Figure (1D): ABCDE Bundle
Adopted from (Morandi, Brummel, &Ely, 2011).**

The Critical Care Nurse role (CCN) in the application of the Awakening and Breathing Coordination Trials (ABCs)

To implement a successful bundle, all patients who connected to the mechanical ventilator must be assessed for the ABC protocol. It needed a systemic routine that based upon the medical staff who taking an informed decisions. As, the CCN is the first one who responsible for performing the Spontaneous Awakening Trials (SAT), then the Respiratory Therapist (RT) assessed patient for performing the Spontaneous Breathing Trials (SBT). Effective and rapid communication among medical team is a successful key for implementation of the SAT and SBT (Jackson, Girard, & Gordon, 2010).

The Awakening and Breathing Coordination process included four major steps: firstly, the SAT Safety Screen. In this step, the CCN assessed patient for interruption of sedation through patient's responding to some

questions according to **Table (1)**, if the patient's answer yes, the CCN should assigned it is NOT SAFE to shut off the patient's continuous sedation. In the case of unsafe, the CCN should continue the patient's sedation and reassessed in the next day (Morandi, Brummel, & Ely, 2011).

Also, the medical staff team should explain the patient's condition in daily rounds. When the patient's answered no, these mean that the patient SAFE to perform a SAT and proceed to **Step 2** that involved the CCN performing a SAT. A SAT involved stopping all continuous sedative infusions. In case of active pain, the continuous analgesic infusions were maintained. During the SAT, the CCN should stop all sedative boluses. When the patient complained of pain, the CCN should administered bolus doses of analgesics as ordered (Pandharipande, Banerjee, McGrane, & Ely, 2010).

Table (1B): Awakening and Breathing Coordination Trials Steps (ABCs):

Step 1:- The researcher determined if it is safe to stop sedation through these safety screen questions:	Step 2:- The researcher determined if the patient ready to stop sedation through Spontaneous awakening trial failure criteria:	Step 3:- The Respiratory Therapist determined if it safe to perform a Spontaneous breathing trial:	Step 4:- The Respiratory Therapist determined if the patient ready to perform Spontaneous breathing failure criteria:
<ul style="list-style-type: none"> The patient had sedation for active seizures? 	<ul style="list-style-type: none"> Patient saturation < 88 % for 5 minutes or longer 	<ul style="list-style-type: none"> Patient's saturation of oxygen <88%? 	<ul style="list-style-type: none"> Respiratory rate more than 35 breaths per minute for 5 minutes or longer
<ul style="list-style-type: none"> The patient received a sedative infusion for alcohol withdrawal? 	<ul style="list-style-type: none"> Respiratory rate more than 35 breaths /minute for 5 minutes or longer 	<ul style="list-style-type: none"> Patient's fraction of inspired oxygen (FIO2) >50%? 	<ul style="list-style-type: none"> Respiratory rate <8
<ul style="list-style-type: none"> The patient received a paralytic agent (neuromuscular blockade)? 	<ul style="list-style-type: none"> There are manifestations of New Acute Cardiac Dysrhythmia. 	<ul style="list-style-type: none"> Patient's set positive end expiratory pressure (PEEP) >7? 	<ul style="list-style-type: none"> Patient saturation of oxygen <88% for 5 minutes or longer
<ul style="list-style-type: none"> There was manifestation of myocardial ischemia in the past 24 hours? 		<ul style="list-style-type: none"> There is previous state of myocardial ischemia in the past 24 hours? 	<ul style="list-style-type: none"> Acute cardiac arrhythmia
<ul style="list-style-type: none"> The patient received sedation to control intracranial pressure? 		<ul style="list-style-type: none"> The patient received vasopressor medications? 	

The Critical Care Nurse (CCN) assessed if the patient ready to interrupt sedation through the SAT failure criteria according to **Table I**. In case of SAT failure criteria, the CCN must continue the patient's sedation as ordered, by administered half the previous dose, then titrate to the sedation target. The CCN will assess patient Step 1 in the next day.

The medical team will discuss the causes of the SAT failure during daily rounds. When patient had the ability to open his/her eyes and responded to verbal stimuli, the CCN should stop sedation and informed the physician that the patient passed on the SAT and asked the RT to perform a SBT Safety Screen. A SAT is considered to be successful in patients who maintained verbal stimuli for four hours and hadn't the failure criteria. In this condition, the CCN should ask the RT to move to step 3 (Sessler, & Pedram, 2009).

Step 3: In this step, the respiratory therapist (RT) determined the patient ability to perform the SBT through patient answers to some questions as mentioned before in table (1B). In case of patient's answers to the SBT Safety Screen questions were YES, the RT will report it is not safe to perform a SBT. The RT will continue mechanical ventilation and reassessed patient in the next day. Also, he will ask the CCN to restart sedatives at the half dose from the previous dose just if needed, and reduced the necessary dose to maintain sedation target. The medical team will discuss the patient's condition during daily rounds. If the patients' questions were answered NO, the RT will report it is ready to perform a SBT and proceed to step 4 (Hooper, Girard, 2009).

Step 4: In that phase, the RT changed the ventilator settings to

Continuous Positive Airway Pressure (CPAP) with pressure support 5, PEEP 5, by using T-piece). The RT assessed patient toleration for the SBT through spontaneous breathing trial failure criteria. In case of failure criteria, the RT will report that the patient had failed the SBT and restart mechanical ventilation at previous settings then he will inform the CCN of this state and remind her to restart sedatives at half the previous dose. The CCN and RT will evaluate the patient in next day starting with Step 1. If the patient tolerated spontaneous breathing for 30–120 minutes without failure criteria, the RT will inform the CCN and physician that the patient had passed in this step (Ely, et al., 2012).

The critical care nurses (CCNs) are the most important key in the ICU who improve patients' quality of care and outcomes through detecting delirium early, determining causes of delirium, and promoting knowledge of care. Critically ill patients are at a great risk for the development of delirium in the ICU. Complications of delirium can be avoided by proper identification and modification of the risk factors of delirium and appropriate interventions will decrease the severity and time of delirium (Sole, Klein, & Moseley, 2012).

The Critical Care Nurses (CCNs) have an active role in reducing of delirium in the ICU patients such as: toleration from sedation at daily round, maintain communication, encourage mobility protocol, optimizing pain management with analgesic, performing cognitive stimulation, keeping sleep wake cycle well, visual and auditory stimulation, encouraging patients for using eye glasses and hearing aids, removing earwax and avoided

dehydration rapidly
(Kalabalik, Brunetti & EL-Srougy, 2014).

Also, the CCN must ensure that the ICU unit has a strategy for the assessment of delirium that performs at least once per shift. There are many validated tools that used to predict delirium early, and evaluate patients for potential risk factors such as: (CAM-ICU or ICDSC) (Colombo et al., 2012). These strategies including the following: decreasing benzodiazepine usage, titration sedation, daily awakening trials, performing early progressive mobility and exercise for all critically ill patients, evaluating patients for causes of delirium including medications (especially benzodiazepines) (Needham et al., 2010).

The Intensive Care Unit (ICU) team must have a goal from sedation and agitation scale that maintain patient calm and cooperative. Every day at morning during staff rounds, the CCN will report the medical team of the patient's sedation level, and agitation, delirium score, sedative and analgesic medication that the patient administered. The researchers found different types of valid and reliable tools that can be used to assess sedation level and detected delirium early as: the Richmond Agitation Sedation Scale (RASS), and Sedation Agitation Scale (SAS) (Pun, & Boehm, 2011).

Delirium will be managed well when the medical team identified and treated the cause of the disease each daily rounds, and discussed possible causes of the patient's delirium (**THINK**). It's a useful key that collected

all possible causes of delirium in ICU (Kim, & Hong, 2015) such as: toxic situations and medications, congestive heart failure, shock, dehydration, new organ failure (e.g., liver, kidney), delirio-genic medications as: (benzodiazepines, anticholinergic medications, and steroids), Hypoxemia, Infection and sepsis (nosocomial), inflammation, immobilization. Non-pharmacological interventions, and potassium or other electrolyte imbalance (Pun, & Boehm, 2011; Pohlman, Schweickert & Pohlman, 2010).

The medical staff assessed the patient's ability for mobilization which included: physical therapist that assessed the patient's condition to move, and the CCN who assessed physiologic status. The respiratory therapist is responsible for maintaining the patient's airway. In addition, the physician tested the patient for any complications that disturbed patients' mobility (Needham et al., 2010). See **table (IC)**.

There are different resources which describing early mobility procedures in the ICU such as protocol provided by the Agency for Healthcare Research and Quality. According to this protocol, every patient is assessed when admitted to the ICU and reassessed during daily rounds. If activity has been restricted due to instability of patient, the team reevaluated the patient in the next day. Each patient had the right to move at least once per day through a three-step process; depending on the highest level of physical activity they can tolerate (Ross & Morris, 2010).

Table (IC): Patient's Criteriafor Early Mobility Protocol:-

Mnemonic	Explanation
M- Myocardial state	<ul style="list-style-type: none"> No active myocardial ischemia through 24 hrs. No dysrhythmia in the day.
O- Oxygensaturation	<ul style="list-style-type: none"> FiO2 less than 0.6 PEEP less than 10 cm H2O
V- Vasopressor medications	<ul style="list-style-type: none"> No increase of any vasopressor medicationsin 2 hrs.
E- Encourage to speak	<ul style="list-style-type: none"> Patient responds to verbal stimuli

Progressive Mobility

This protocol consisted of four levels of activity. Firstly: passive range of motion that performed by the mobility team (The Physical Therapy, and CCN), and changed every 2 hours. Physical therapy transferred to the second level, which included active resistance physical therapy, and put patients in the sitting position three times per day and lasted for 20 minutes. Activity increased in the third and fourth levels which started from sitting on the edge of the bed, to activetransferred patients to a chair out of the bed (Pohlman,Schweickert&Pohlman, 2010).

When delirium occurred, high risk patients and their families should be informed for the risk of delirium to encourage them in dealing with these symptoms in right ways without causing any problems. To maintain more safe ICU environment, regular sleep wake cycle can be maintained with reduced noise through (monitors, alarms, pumps), and orientation patients of time and date. Knowing the hospital name, psychological support from family and putting favorite photos at bedside can be also helpful for decreasing delirium (Weinhouse, 2014).

The ACCM guidelines 2013advocatedthe importance of early mobilizationto reduce the incidence and duration of delirium. Moreresearches recommended that early mobilization in

non ICU patients, increased synaptic transmission and neurotransmitter release, and improving cognitive function as part of its neuro protective effect.(Hopkins, Suchyta, Farrer, &Needham, 2012;Bryczkowski,Lopreiato,Yonclas, Sacca, &Mosenthal, 2014).

Physical restraints among critically ill patients are used to facilitate efficient patient care, by preventing self-removal of devices needed to provide life supporting treatment. Also, Physical restraints should be minimized during mechanical ventilation. However, it has been reported to increase delirium, agitation and the risk of unplanned extubation. So; the CCN should use physical restraints in appropriate situations short duration not for a routine. If restraints are needed, the CCN should use it in combination with sedation medication to decrease agitation(Lopez,Aldecoa, & Rico, 2013);Kim, & Hong, 2015; Inouye, Westendorp, &Saczynski, 2014).

The American College of Critical Care Medicine (ACCM) guidelines 2013, suggested that the awakening and breathing coordination, delirium monitoring, and early mobility (ABCDE) approach is an evidence based bundle, which have several practices to prevent brain disorders in mechanically ventilated patients, and it has been considered to be a useful protocol for monitoring the mechanically ventilated

patient to reduce delirium. The ABCDE includes interruption of sedation and ventilator support (Awakening and Breathing Coordination Trials), the choice of right sedatives and analgesics, daily monitoring for delirium and early mobilization (Morandi, Brummel, & Ely, 2011).

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