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The ABCDEF Bundle in Critical Care

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SYNOPSIS

The ABCDEF bundle represents an evidence-based guide for clinicians to approach the organizational changes needed for optimizing ICU patient recovery and outcomes. The **ABCDEF** bundle includes: **A**ssess, Prevent, and Manage Pain, **B**oth Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT), **C**hoice of analgesia and sedation**, D**elirium: Assess, Prevent, and Manage, **E**arly mobility and Exercise, and **F**amily engagement and empowerment. In this chapter, we will review the core evidence and features behind the ABCDEF bundle. The bundle has individual components that are clearly defined, flexible to implement, and help empower multidisciplinary clinicians and families in the shared care of the critically ill. The ABCDEF bundle helps guide well-rounded patient care and optimal resource utilization resulting in more interactive ICU patients with better controlled pain, who can safely participate in higher-order physical and cognitive activities at the earliest point in their critical illness.

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With more than 4 million ICU admissions per year in the US, there is increasing recognition of the long-term consequences of ICU care on the physical and mental health function of our patients. An acute care hospitalization and critical illness has tangible consequences of cognitive decline,[1] post-traumatic stress disorder,[2] and depression.[3] In a multicenter cohort of 821 critically ill patients, with respiratory failure or shock, our group demonstrated that one of four ICU patients had cognitive impairment after 12 months after critical illness that was similar in severity to that of patients with mild Alzheimer's disease and moderate traumatic brain injury.[4] The largest risk factor for this ICU-related cognitive impairment was delirium. Disability associated with ICU care and hospitalization is an unfortunately common occurrence in older adults with significant consequences for patients and caregivers (Figure 1).[5]

ICU survivorship has become a top concern and methods to optimize patient recovery and outcomes are important objectives for the health provider, families, and researchers. In 2013, the American College of Critical Care Medicine, in collaboration with the Society of Critical Care Medicine and American Society of Health-System Pharmacists, updated the Clinical Practice Guidelines for the Management of Pain, Agitation, and Delirium in Adult Patients in the Intensive Care Unit (ICU PAD Guidelines) to provide recommendations for clinicians to better manage critically ill patients.[6] Many elements of the symptom-based ICU PAD guideline can be implemented using an interdependent, multicomponent, evidence-based guide for the coordination multidisciplinary ICU care - the ABCDEF bundle. The **ABCDEF** bundle includes: **A**ssess, Prevent, and Manage Pain (**A**), **B**oth Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT) (**B**), **C**hoice of analgesia and sedation (**C**), **D**elirium: Assess, Prevent, and Manage (**D**), **E**arly mobility and Exercise (**E**), and **F**amily engagement and empowerment (**F**).

A: Assess, Prevent, and Manage Pain

ICU patients commonly experience pain, with an incidence of up to 50% in surgical and medical patients. It is a major clinical symptom that requires systematic diagnosis and treatment.[7,8] In a prospective, cross-sectional, multicenter, multinational study of pain intensity associated with 12 procedures, the Europain study, Puntillo et al. showed that common ICU procedures induced a significant increase in pain, although no procedure caused severe pain. For the three most painful procedures (i.e., chest tube removal, wound drain removal, and arterial line insertion) pain intensity more than doubled during the procedure compared with the pre-procedural levels.[9]

Assessment of pain is the first step before administering pain relief. Pain assessments are often only performed 35% of the time before ICU procedures.[7] Patient's self-report of pain using a 1–10 numerical rating scale (NRS) is considered the gold standard and is highly recommended by many critical care societies.[6,8] Because of the high interrelation between

delirium and pain,[8] assessing and treating pain could be important in the prevention and/or management of delirium.

In the absence of a patient's self-report, observable behavioral and physiological indicators become important indices for the assessment of pain.[10] The Behavioral Pain Scale (BPS) and the Critical-Care Pain Observation Tool (CPOT) are the most valid and reliable behavioral pain scales for ICU patients unable to communicate (Figure 2). The BPS is composed of 3 subscales: facial expression, movement of the upper limbs, and compliance with mechanical ventilation (MV). Each subscale is scored from 1 (no response) to 4 (full response). A BPS score of 5 or higher is considered to reflect unacceptable pain. The CPOT has 4 components: facial expression, body movements, muscle tension, and compliance with the ventilator for intubated patients or vocalization for extubated patients. Each component is scored from 0 to 2 with a possible total score ranging from 0 to 8. A CPOT ≥ 3 is indicative of significant pain. Both the BPS and the CPOT provide guidance for the selection of pharmacological interventions for pain and in the evaluation of their effectiveness.[11,12]

According to ICU PAD Guidelines, pain medications should be routinely administered in the presence of significant pain (i.e., NRS >4, BPS >5, or CPOT >3) and prior to performing painful invasive procedures. Parenteral opioids are first-line pharmacologic agents for treating non-neuropathic pain in critically ill patients. All opioids have the potential to induce tolerance over time, resulting in the need for escalating doses to achieve the same analgesic effect. For the treatment of neuropathic pain in ICU patient gabapentin or carbamazepine should be administered enterally, in addition to opioids. Non-opioid analgesics, such as acetaminophen, nonsteroidal anti-inflammatory drugs, or ketamine, should be used as adjunctive pain medications to reduce opioid requirements and opioid-related side effects ill. Use of regional analgesia in ICU patients is limited to the use of epidural analgesia in specific subpopulations of surgical patients, and in patients with traumatic rib fractures.[6] In managing pain in the ICU, non-pharmacological methods are often effective and safe (e.g., injury stabilization, patient repositioning, use of heat/cold).[13]

B: Both Spontaneous Awakening Trials (SAT) and Spontaneous Breathing Trials (SBT)

Daily SATs are the stopping of narcotics (as long as pain is controlled) and sedatives every day and, if needed, restarting either narcotics or sedatives at half the previous dose and titrating as need. Daily interruption of sedation shortens the duration of mechanical ventilation and the ICU length of stay. The 2013 ICU PAD Guidelines emphasize the importance of minimizing sedative use and maintaining a light level of sedation in patients, using either a daily sedative interruption strategy (i.e., SAT), or by continuously titrating sedatives to maintain a light level of sedation (i.e., targeted sedation strategy). Kress et al. conducted a randomized, controlled trial involving 128 adult patients who were receiving mechanical ventilation and continuous infusions of sedative drugs in a medical ICU (MICU). In the intervention group, the sedative infusions were interrupted daily until the patients were awake; in the control group, the infusions were interrupted only at the discretion of the clinicians. In this study, daily interruption of the infusion of sedative drugs

shortened the duration of mechanical ventilation by more than 2 days and the length of stay in the intensive care unit by 3.5 days.[14] These data suggest that daily SAT uses less analgosedation while improving ICU outcomes.[14]

There is a consistent relationship between deeper sedation and worse ICU outcomes. Deep sedation in the first 48 hours of an ICU stay has been associated with delayed time to extubation, higher need for tracheostomy, increased risk of hospital and long term death.[15–17] Shehabi et al. examined the relationships between early sedation and time to extubation, delirium, hospital and 180-day mortality among ventilated critically ill patients in the intensive care unit. Every additional Richmond Agitation-Sedation Score (RASS) assessment in the deep sedation range in the first 48 hours was associated with delayed time to extubation of 12.3 hours, a 10% increased risk of hospital death, and an 8% increased risk of death at 6 months.[15] Balzer et al. examined short and long-term survival after deep sedation during the first 48 hours after ICU admission. In this study, 1,884 patients receiving mechanical ventilation were grouped as either lightly or deeply sedated (light sedation: RASS -2 to 0; deep: RASS -3 or below). Deep sedation (27.2%, n=513) was associated with an in-hospital mortality hazard ratio of 1.661 (95% CI: 1.074 to 2.567; P = 0.022) and a two-year hazard ratio of 1.866 (95% CI: 1.351 to 2.576; P <0.001). In summary, deeply sedated patients had longer ventilation times, increased length of stay and higher rates of mortality.[17] These studies show that early deep sedation is a modifiable risk factor and that the implementation of sedation protocols to achieve light sedation is feasible and reproducible in the early phase of ICU treatment.

Daily SBT has been proven to be effective and superior to other techniques to ventilator weaning. Numerous randomized trials support the use of ventilator weaning protocols that include daily SBTs as their centerpiece.[18,19] About two-thirds of the time on mechanical ventilation is spent during weaning, so anything that reduced this period would have a very high likelihood of improving outcomes. Girard et al. undertook the Awakening and Breathing Controlled (ABC) trial, a multicenter, randomized controlled trial to assess the efficacy and safety of a protocol of daily SATs paired with SBTs (intervention group**,** n=168) versus a standard SBT protocol in patients receiving patient-targeted sedation as part of usual care (control group, n=168).[20] Patients in the intervention group (both SAT and SBT) spent more days breathing without assistance during the 28-day study period (14.7 days versus 11.6 days; mean difference 3.1 days, 95% CI: 0.7–5.6, p=0.02) and were discharged earlier from the ICU (median time in ICU of 9.1 days versus 12.9 days, p=0.01) and earlier from the hospital (median hospital time 14.9 days versus 19.2 days, p=0.04).[20] During the year after enrollment, patients receiving SATs with SBTs (intervention) were less likely to die than were patients receiving only SBTs (control) (hazard ratio=0.68, 95% CI: 0.50–0.92, p=0·01). For every seven patients treated with the intervention, one life was saved (number needed to treat was 7.4, 95% CI: 4.2–35.5).[20] Conversely in the SLEAP trial (protocolized light sedation in combination with daily SAT versus protocolized light sedation alone), found no difference between the groups with regard to time to extubation, duration of ICU and hospital stays.[21] One reason the SLEAP study might not have showed an effect is because both the treatment and control groups received high sedative doses that would result in moderate to deep levels, rather than light levels of sedation.[22]

No sedation has also been applied as a strategy in ICU patients. Strøm et al. enrolled 140 critically ill adult patients who were undergoing mechanical ventilation and were expected to need ventilation for more than one day. Patients were randomly assigned in a 1:1 ratio (unblinded) to receive no sedation (n=70 patients) or sedation (n=70, control group). Patients receiving no sedation had significantly more days without ventilation (mean 13.8 days, SD 11.0 vs mean 9.6 days, SD 10.0; mean difference 4.2 days, 95%: CI 0.3–8·1. p=0.0191) in a 28-day period, and reduced stays in the ICU and hospital. This study did find increased hyperactive delirium in the group receiving no sedation.[23]

Ultimately, the core features of the ABCDEF bundle involve coordination of SATs and SBTs emphasizing narcotic and sedation titration resulting in earlier liberation from mechanical ventilation, ICU, and hospitalization (Figure 3).

C: Choice of analgesia and sedation

Although, we have discussed pain assessment and management earlier, the 2013 PAD guidelines emphasize the need for goal-directed delivery of psychoactive medications to avoid over-sedation, to promote earlier extubation, and to help the medical team agree on a target sedation level by using sedation scales. Of the available reliable and valid sedation scales, the PAD guidelines recommend the use of the Richmond Agitation-Sedation Scale (RASS) and the Riker Sedation-Agitation Scale (SAS). Figure 4 shows the psychometric properties of both the RASS and SAS. The SAS has 7 individual tiers ranging from “1” (unarousable) to “7” (dangerous agitation).[24] RASS is a 10-point scale, with four levels of escalating agitation (RASS +1 to +4), one level denoting a calm and alert state (RASS 0), three levels of sedation (RASS -1 to –3), and two levels of coma (RASS -4 to -5). A unique feature of RASS is that it relies on the duration of eye contact following verbal stimulation. The RASS takes less than 20 seconds to perform with minimal training, and has been shown highly reliability among multiple types of healthcare providers and an excellent interrater reliability in a broad range of adult medical and surgical ICU patients.[25]

To maximize patient outcomes, it is essential to carefully choose sedatives and analgesic medications, as well as consider medication doses, titration, and discontinuation.[25] For example, there is a clear association between decreased exposure to sedatives, particularly benzodiazepines, and improved patient outcomes.[15,17,26,27] Pandharipande et al. evaluated 198 mechanically ventilated patients to determine the probability of daily transition to delirium, as a function of sedative and analgesic dose administration during the previous 24-hour period. They found that every unit dose of lorazepam was associated with a higher risk for daily transition to delirium (odds ratio=1.2, 95% CI: 1.1–1.4, p=0.003).[28] Similarly Seymour et al. confirmed that benzodiazepines are an independent risk factor for development of delirium during critical illness even when given more than 8 hours before a delirium assessment.[29] These results expand and support the recommendation made in the 2013 ICU PAD guidelines that non-benzodiazepine sedative options may be preferred over benzodiazepine-based sedative regimens.[6]

Two major studies evaluated benzodiazepines against a novel alpha-2-agonist sedative, dexmedetomidine. The SEDCOM trial (Safety and Efficacy of Dexmedetomidine Compared

with Midazolam) showed a reduction in the prevalence of delirium and in the duration of mechanical ventilation in patients sedated with dexmedetomidine compared with midazolam[30] The MENDS study (Maximizing Efficacy of Targeted Sedation and Reducing Neurological Dysfunction) evaluated the role of changing sedation paradigms on acute brain dysfunction, comparing dexmedetomidine with lorazepam.[31] The dexmedetomidine sedative strategy resulted in more days alive without delirium or coma, but without differences in mortality or ventilator-free days. Notably, the subgroup of septic patients sedated with dexmedetomidine in the MENDS study had shorter durations of delirium and coma, lower daily probability of delirium, shorter time on the ventilator, and improved 28-day survival.[32] There is an ongoing trial (MENDS II study) to determine the best sedative medication to reduce delirium and improve survival and long-term brain function in the ventilated septic patient (ClinicalTrials.gov Identifier: NCT01739933).

D: Delirium: Assess, Prevent, and Manage

An important third element in the PAD guidelines is monitoring and management of delirium. Delirium is a disturbance in attention and awareness that develops over a short period of time, hours to days, and fluctuates over time.[33] Over 80% of patients developed delirium during their hospital stay, with the majority of cases occurring in the ICU with an average time of onset between the second and the third day.

Several methods have been developed and validated to diagnose delirium in ICU patients but the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU, Figure 5A) and the Intensive Care Delirium Screening Checklist (ICDSC, Figure 5B) are the most frequently employed tools for this purpose.[34] The ICDSC checklist is an eight-item screening tool (one point for each item) that is based on DSM criteria and applied to data that can be collected through medical records or to information obtained from the multidisciplinary team.[34] The pooled values for the sensitivity and specificity of the ICDSC are 74% and 81.9%, respectively.[34] The CAM-ICU is composed by four features 1) acute onset of mental status changes or fluctuating course; 2) inattention; 3) disorganized thinking; and 4) altered level of consciousness. The patient is considered CAM positive and, so delirious, if he/she manifests both features 1 and 2, plus either feature 3 or 4.[35] Overall accuracy of the CAM-ICU is excellent, with pooled values for sensitivity and specificity of 80% and 95.9%, respectively.[34] The CAM-ICU has been modified and validated in pediatric, emergency department, and neurocritical care populations, as well as translated in over 25 languages[36–40].

Delirium can be categorized into subtypes according to psychomotor behavior. Hyperactive delirium (CAM positive, RASS positive range) is associated with a better overall prognosis and it is characterized by agitation, restlessness, and emotional lability.[41] Hypoactive delirium (CAM positive, RASS negative range), which is very common and often more deleterious in the long term, is characterized by decreased responsiveness, withdrawal, and apathy and remains unrecognized in 66 to 84% of hospitalized patients.[42] Another categorization based on the ICDSC score assigns patients with a score of 0 to have no delirium, those with a score ≥ 4 to have clinical delirium, and those with a score of 1–3 to

have subsyndromal delirium.[43] Whichever delirium metric is used, the best picture of the patient's mental status comes from assessing delirium serially throughout the day.

Evidence shows that delirium is a strong predictor of increased length of mechanical ventilation, longer ICU stays, increased cost, long-term cognitive impairment, and mortality (Figure 6).[19,44–47] The cumulative effect of multiple days of delirium on mortality may be multiplicative, rather than additive.[48]

Numerous risk factors for delirium have been identified, including preexisting cognitive impairment, advanced age, use of psychoactive drugs, mechanical ventilation, untreated pain, and a variety of medical conditions such as heart failure, prolonged immobilization, abnormal blood pressure, anemia, sleep deprivation, and sepsis.[42,49] The most frequent risk factor was the use of benzodiazepines or narcotics (98%).[44] The mean number of identified risk factors for delirium in these patients was 11±4 with a range of 3–17 risk factors present. Patients with 3 or more risk factors were considered at high risk for delirium.[42,49,50] In delirious patients, a systematic protocolized search for all reversible precipitants is the first line of action and symptomatic treatment should be considered when available and not contraindicated (Figure 7).[51]

Antipsychotics, especially haloperidol, are commonly administered for the treatment of delirium in critically ill patients. However, evidence for the safety and efficacy of antipsychotics in this patient population is lacking. Moreover, the 2013 PAD Guidelines include no specific recommendations for using any particular medication.[6] Ely et al. are conducting the MIND-USA (Modifying the Impact of ICU-Induced Neurological Dysfunction-USA) Study (ClinicalTrials.gov Identifier NCT01211522) to define the role of antipsychotics in the management of delirium in vulnerable critically ill patients.

Delirium prophylaxis with medications is discouraged in the PAD guidelines. Recently, a prospective, randomized, multicenter trial compared a low-dose haloperidol infusion administered for 12 hours (0.5 mg intravenous bolus injection followed by continuous infusion at a rate of 0.1 mg/h, n=229 patients) against placebo (n = 228 patients) in the immediate postoperative period. This study provided evidence that haloperidol could reduce the incidence of delirium within the first 7 days postoperatively in patients undergone noncardiac surgery (15.3% in the haloperidol group versus 23.2% in the control group, p=.031).[52] By contrast, another ICU study showed no benefit of early administration of intravenous haloperidol in a mixed population of medical and surgical adult ICU patients.[53] In this double-blinded, placebo-controlled randomized trial, 142 patients were randomized to receive haloperidol or placebo intravenously every 8 hours irrespective of coma or delirium status. Patients in the haloperidol group spent about the same number of days alive, without delirium or coma, as did patients in the placebo group (median 5 days [IQR 0–10] versus 6 days [0–11] days; p=0.53).

The only strategy strongly recommended in the PAD Guidelines, to reduce the incidence and duration of ICU delirium and to improve functional outcomes, is promoting sleep hygiene to prevent sleep disruption and the use of early and progressive mobilization and in these patients.

E: Early mobility

Early mobility is an integral part of the ABCDEF bundle and has been the only intervention resulting in a decrease in days of delirium.[54] During ICU stay critically ill patients can lose up to 25% peripheral muscle weakness within 4 days when mechanically ventilated and 18% in body weight by the time of discharge and this process is higher in the first 2–3 weeks of immobilization.[55] The consequence of physical dysfunction in critically ill patients can be profound and long-term with significant reduction in functional status being observed even 1 year and 5 years after ICU discharge.[56–58]

ICU-acquired weakness is caused by many different pathophysiological mechanisms that are not mutually exclusive given the diverse diseases that precipitate critical illness, the drugs used during its management, and the consequences of protracted immobility.[54] The reported incidence of ICU-acquired weakness ranges from 25 to 100%.[59,60] The diagnosis of ICU-acquired weakness is made by the Medical Research Council (MRC) scale for grading the strength (i.e., 0, total palsy to 5, normal strength) of various muscle groups in the upper and lower extremities. The scale ranges from 0 (complete tetraplegia) to 60 (normal muscle strength), with a score < 48 is diagnostic of ICU-acquired weakness.[61] Patients with ICU-acquired weakness should undergo serial evaluations, and if persistent deficits are noted, electrophysiological studies, muscle biopsy, or both are warranted.[54]

Although clinical providers may have fears about early mobilization, there is good evidence regarding the strategy of minimizing sedation and increasing the physical activity of ICU patients to the point of getting up and out of bed.[54] Physical therapy has shown to be feasible, safe, even in the most complicated patients receiving the most advanced medical therapies (e.g., continuous renal replacement therapy, extracorporeal cardiopulmonary support).[62,63] Early activity can be done without increases in usual ICU staffing and with a low risk (<1%) of complications.[64] Studying patients early in the their course of mechanical ventilation (<3 days), Schweickert et al. showed that a daily SAT combined with physical and occupational therapy, versus SAT alone, resulted in an improved return to independent functional status at hospital discharge, shorter duration of ICU-delirium, higher survival, and more days breathing without assistance.[65] However, in a study where ICU patients were enrolled 4 days after the initiation of mechanical ventilation (average 8 days), an intensive physical therapy program did not improve long-term physical functioning when compared to a standard of care program [66]. Although both these studies demonstrated feasibility of physical therapy, it may more effective to embark on physical therapy early in the ICU course, rather than later when it is much more challenging to improve ICU-acquired weakness.[65,66]

The focus on rehabilitation of critically ill patients should begin in the ICU and continue all the way to recovery at home. The close collaboration and coordination with medicine, nursing, and physical therapists is fundamental for an efficacy and safe strategy.[62] This is particularly important because the burden of illness affects not only the patient but his or her family or other caregivers as well.[54]

F: Family engagement

The ABCDE bundle has evolved to include Family Engagement, as no ICU treatment plan is complete without incorporation of the family's wishes, concerns, questions, and participation. Family members and surrogate decision makers must become active partners in multi-professional decision-making and treatment planning. Through this partnership, patients' preferences can be identified, the anxiety of families can be lessened, and physicians can have appropriate input into decisions.[67]

Family presence on ICU rounds is beneficial, and it does not interfere with education and communication process.[68] Families have reported increased feelings of inclusion, respect, and having a better understanding of their loved one's care. Nurses have indicated satisfaction with team communication and facilitation of family relationships.[69] Several studies suggested that increased focus on communication with family members, through routine ICU family conferences, palliative care consultation, or ethics consultation can reduce ICU length of stay for those patients whose trajectory is ultimately mortal.[70–73] One study of communication occurring during ICU family conferences sought to understand how ICU clinicians conduct communication concerning withdrawing life-sustaining treatments or the delivery of bad news, and how this communication might be improved.[74] Most clinicians failed to listen and respond appropriately, failed to acknowledge the expression of family members' emotions, and failed to explain key tenets of palliative care. An important missed opportunity when communicating with families is exploring patient treatment preferences that are key to clinical decision making in the ICU setting.[74]

Ethics and palliative care consultations have been introduced into the practice of medicine during the past several decades as a way to help health care professionals, patients, and surrogates come to a decision about medical treatment ensuring that the process of decision making is inclusive, educational, respectful of cultural values, and reflect appropriate resource utilization. When ethics consultation have been used, they have been associated with reductions in hospital and ICU lengths of stay, and more frequent decisions to forgo life-sustaining treatment.[72,75] When tackling treatment conflicts, the majority (87%) of ICU physicians, nurses, and patients/surrogates agreed that ethics consultations are helpful. However, in a recent randomized study in 4 medical ICUs in those receiving mechanical ventilation for greater than one week, family discussions conducted by palliative care specialists (intervention) versus standard ICU led family discussions (control) did not alter anxiety or depression symptoms in surrogate decision makers.[76]

Beyond sharing of communication, family presence has been encouraged in traumatizing medical events and procedures, such as Cardiopulmonary Resuscitation (CPR). In some studies, the family presence during CPR is associated with positive results on psychological variables, and did not interfere with medical efforts, increase stress in the health care team, or result in medicolegal conflicts. In fact, relatives who did not witness CPR had symptoms of anxiety and depression more frequently than those who did witness CPR.[77]

Critical illness usually impacts not only an individual, but their entire support system, which may or may not be their nuclear family, or some combination of family and friends or other

caregivers who are actively engaged in supportive roles. In light of this, it is crucial not only to recognize the needs of the identified patient but the needs of their family as well.

Summary

We have reviewed the core evidence and features behind the ABCDEF bundle, which was created to combat the adverse effects of critical illness related to acute and chronic brain dysfunction. The ABCDEF bundle represents one method of approaching the organizational changes that create a culture shift in our 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 healthcare providers in higher-order physical and cognitive activities at the earliest point in their critical illness.

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KEY POINTS

1. The ABCDEF bundle is an evidence-based guide for clinicians to coordinate multidisciplinary patient care in the intensive care unit (ICU).
2. Assessment of pain is the first step before administering pain relief. The Behavioral Pain Scale (BPS) and the Critical-Care Pain Observation Tool (CPOT) are the most valid and reliable behavioral pain scales for ICU patients unable to communicate.
3. Coordination of Spontaneous Awakening Trials (SAT) with Spontaneous Breathing Trials (SBT) is associated with decreases in sedative use, delirium, time on mechanical ventilation, and ICU and hospital lengths of stay.
4. Delirium monitoring and management is critically important since it is a strong risk factor for increased time on mechanical ventilation, length of ICU and hospital stay, cost of hospitalization, long term cognitive impairment, and mortality.
5. Early mobility is the only currently known intervention associated with a decrease in delirium duration. Physical therapy is safe and feasible in the ICU, even while on mechanical ventilation, renal replacement therapy, and/or circulatory support.

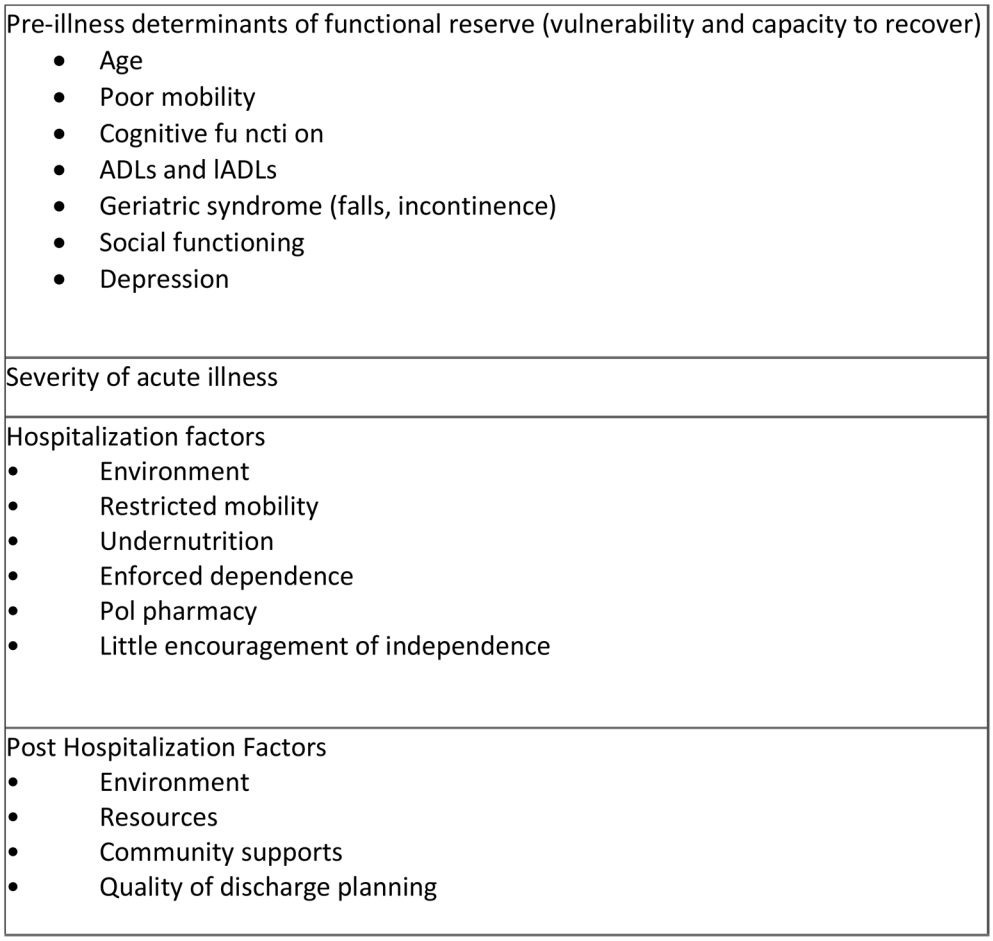

Figure 1.

Factors related to Hospitalization-Associated disability

Data from Covinsky KE, Pierluissi E, Johnston CB. Hospitalization-associated disability: "She was probably able to ambulate, but I'm not sure". JAMA. 2011 Oct 26;306(16):1782–93. doi: 10.1001/jama.2011.1556.

Critical Pain Observational tool (CPOT)		Behavioral Pain scale (BPS)	
	Score		Score
Facial expressions:		**Facial expressions:**	
• *Relaxed, Neutral*	0	• *Relaxed*	1
• *Tense*	1	• *Partially tightened*	2
• *Grimacing*	2	• *Fully tightened*	3
Body movements		**Upper limbs**	
• *Absence of movements or normal position*	0	• *No movement*	1
		• *Partially bent*	2
• *Protection*	1	• *Fully bent with finger flexion*	3
• *Restlessness /agitation*	2	• *Permanently retracted*	4
Compliance with the ventilator (intubated patients)		**Compliance with ventilation**	
		• *Tolerating movement*	1
• *Tolerating ventilator or movement*	0	• *Coughing but tolerating ventilation for most of the time*	2
• *Coughing but tolerating*	1		
• *Fighting ventilator*	2	• *Fighting ventilator*	3
		• *Unable to control ventilation*	4
Vocalization (non-intubated patients)			
• *Talking in normal tone or no sound*	0		
• *Sighing, moaning*	1		
• *Crying out, sobbing*	2		
Muscle tension			
• *Relaxed*	0		
• *Tense, rigid*	1		
• *Very tense or rigid*	2		

BPS >5, or CPOT >3 are indicative of significant pain

Figure 2.

Clinical Pain Observational Tool (CPOT) and Behavioral Pain Scale (BPS)

Adapted from Payen JF, Bru O, Bosson JL, et al Assessing pain in critically ill sedated patients by using a behavioral pain scale Crticial Care Med. 2001 Dec;29(12):2258–63; with permission.

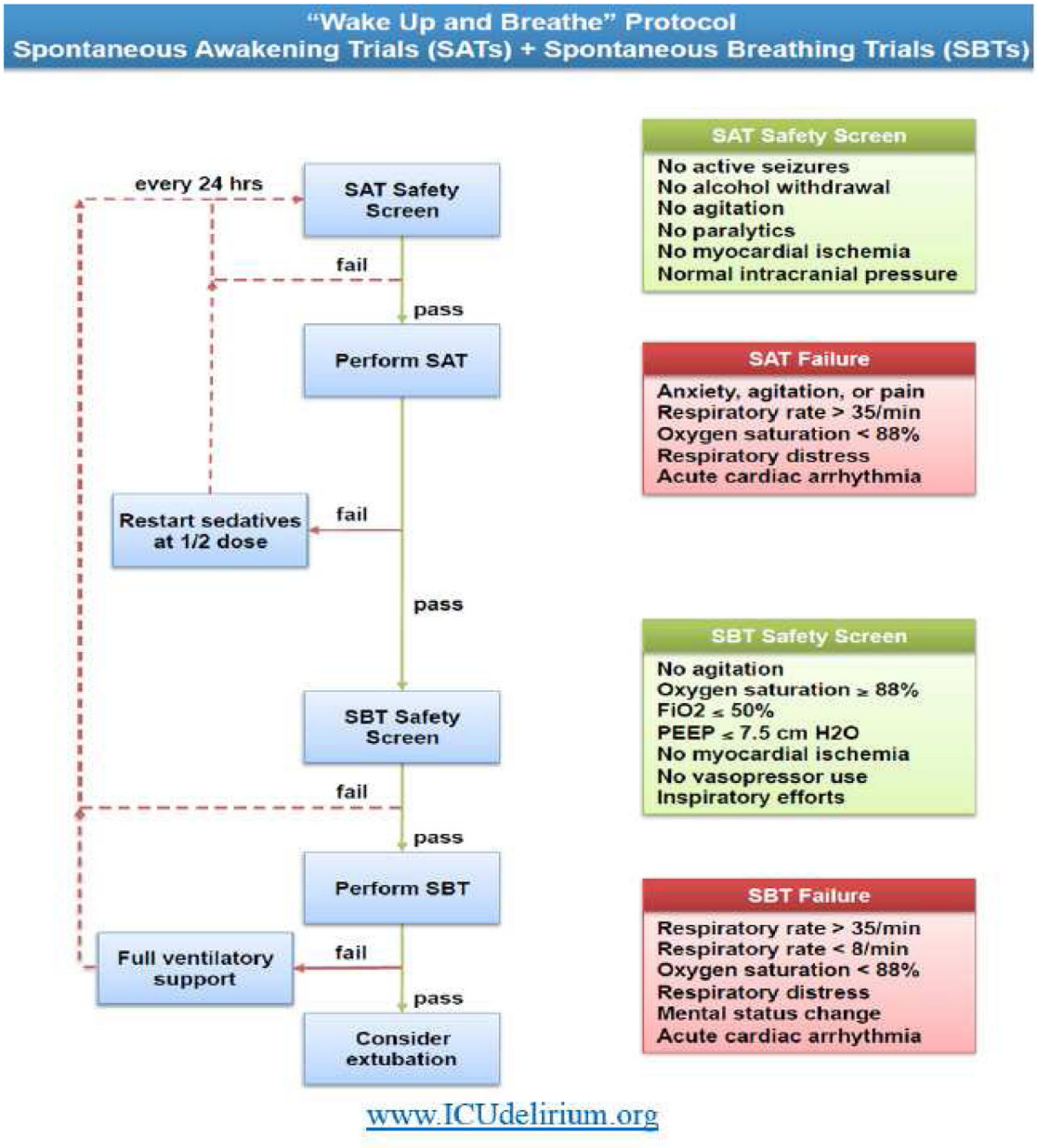

Figure 3.

"Wake up and Breath" Protocol: Spontaneous Awakening Trials (SATs) with Spontaneous Breathing Trials

RASS	SAS
+4 Combative Combative, violent, immediate danger to staff	7 Dangerous Agitation Pulling at ET tube, trying to remove catheters, climbing over bedrail, striking at staff, trashing side-to-side
+3 Very Agitated Pulls to remove tubes or catheters; aggressive	6 Very Agitated Requiring restraint and frequent verbal reminding of limits, biting ETT
+2 Agitated Frequent non-purposeful movement, fights ventilator	6 Very Agitated Requiring restraint and frequent verbal reminding of limits, biting ETT
+1 Restless Anxious, apprehensive, movements not aggressive	5 Agitated Anxious or physically agitated, calms to verbal instructions
0 Alert and Calm Spontaneously pays attention to caregiver	4 Calm and Cooperative Calm, easily arousable, follows commands
-1 Drowsy Not fully alert, but has sustained awakening to voice - eye opening and contact >10 seconds	3 Sedated Difficult to arouse but awakens to verbal stimuli or gentle shaking, follows simple commands but drifts off again
-2 Light Sedation Briefly awakens to voice - eyes open and contact <10 seconds	3 Sedated Difficult to arouse but awakens to verbal stimuli or gentle shaking, follows simple commands but drifts off again
-3 Moderate Sedation Movement or eye opening to voice - no eye contact	3 Sedated Difficult to arouse but awakens to verbal stimuli or gentle shaking, follows simple commands but drifts off again
-4 Deep Sedation No response to voice, but movement or eye opening to physical stimulation	3 Sedated Difficult to arouse but awakens to verbal stimuli or gentle shaking, follows simple commands but drifts off again 2 Very Sedated Arouses to physical stimuli but does not communicate or follow commands, may move spontaneously
-5 Unarousable No response to voice or physical stimulation	1 Unarousable Minimal or no response to noxious stimuli, does not communicate or follow commands

Figure 4.

Richmond Agitation-Sedation Scale (RASS) and Riker Sedation-Agitation Scale (SAS) From ICU Delirium, Vanderbilt University. Available at www.ICUdelerium.org. Adapted from Riker RR, Picard JT, Fraser GL. Prospective evaluation of the sedation-agitation scale for adult critically ill patients. Crit Care Med 1999;27(7):1327, and Sessler CN, Gosnell MS, Grap MJ, et al. The Richmond Agitation–Sedation Scale. Am J Resp Crit Care Med 166:1339

5A

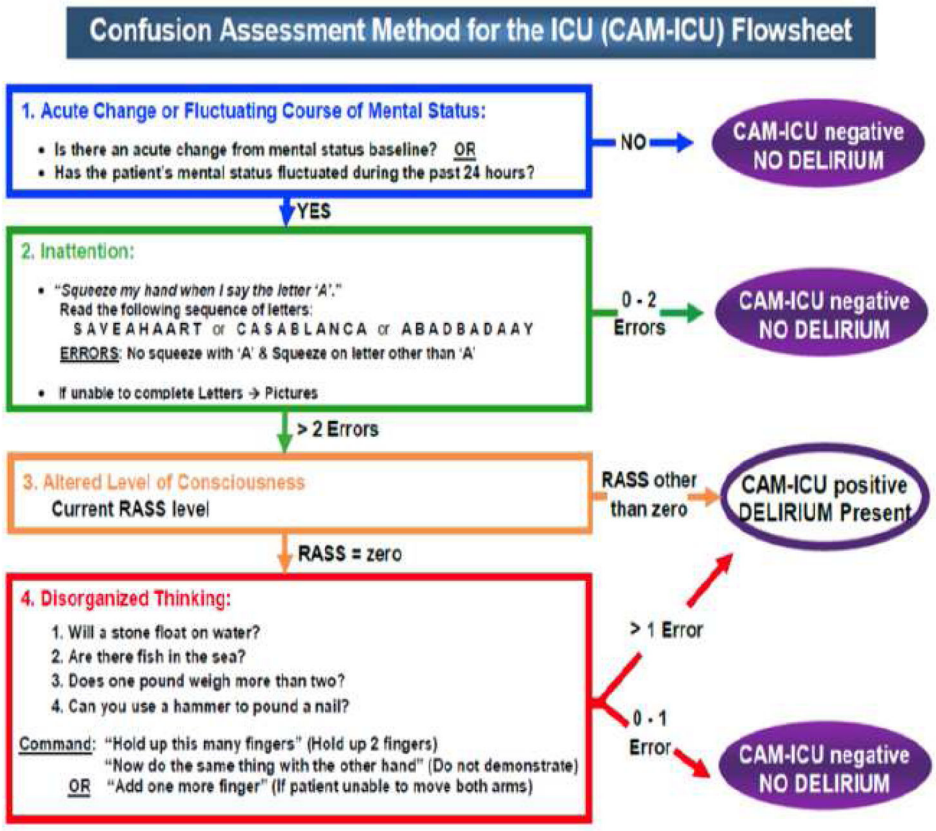

Figure 5B.

Intensive Care Delirium Screening Checklist Worksheet (ICDSC)	No 0	Yes 1
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 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, patient easily distracted by external stimuli . Will not reliably squeeze hands to spoken letter A: SAVEA HAART		
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?		
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?		
5. Psychomotor agitation or retardation		
Either: a) Hyperactivity requiring the use of sedative drugs or restraints in order to control potentially dangerous behavior (e.g. pulling IV lines out or hitting staff) OR b) Hypoactive or clinically noticeable psychomotor slowing or retardation		
6. Inappropriate speech or mood		
Patient displays: inappropriate emotion; disorganized or incoherent speech; sexual or inappropriate interactions; is either apathetic or overly demandi		
7. Sleep-wake cycle disturbance		
Either: frequent awakening/< 4 hours sleep at night OR sleeping during much of the day		
8. Symptom Fluctuation		
Fluctuation of any of the above symptoms over a 24 hr period.		
Total shift score (0-8)		

Figure 5.

(**A**) Confusion Assessment Method for the ICU (CAM-ICU) **(B)** Intensive Care Delirium Screening checklist (ICDSC)

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Normal 0; Delirium4–8: Subsyndromal Delirium 1–3

Score your patient over the entire shift. Components don't all need to be present at the same time. Components 1 through 4 cannot be completed when the patient is deeply sedated or comatose (ie. 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 hrs. should be obtained for components 7 and 8.

Adapted from Bergeron N, Dubois MJ, Dumont M, Dial S, Skrobik Y. Intensive Care Delirium Screening Checklist: evaluation of a new screening tool. Intensive Care Med. 2001 May;27(5):859–64; Ouimet S, Riker R, Bergeron N, Cossette M, Kavanagh B, Skrobik Y. Subsyndromal delirium in the ICU: evidence for a disease spectrum. *Intens CareMed* 2007;33:1007–13. Epub 2007 Apr 3; with permission.

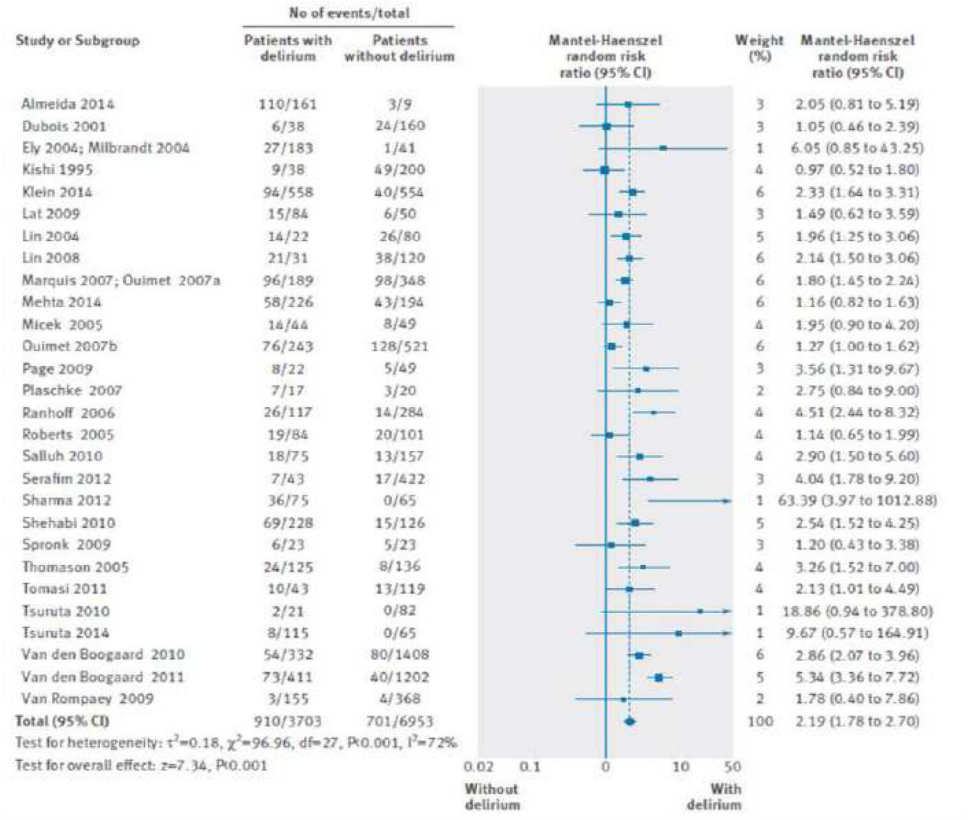

Figure 6.

Impact of delirium on hospital mortality in critically ill patients.

From Salluh JI, Wang H, Schneider EB, et al. Outcome of delirium in critically ill patients: systematic review and meta-analysis. BMJ. 2015 Jun 3;350:h2538. doi: 10.1136/bmj.h2538.

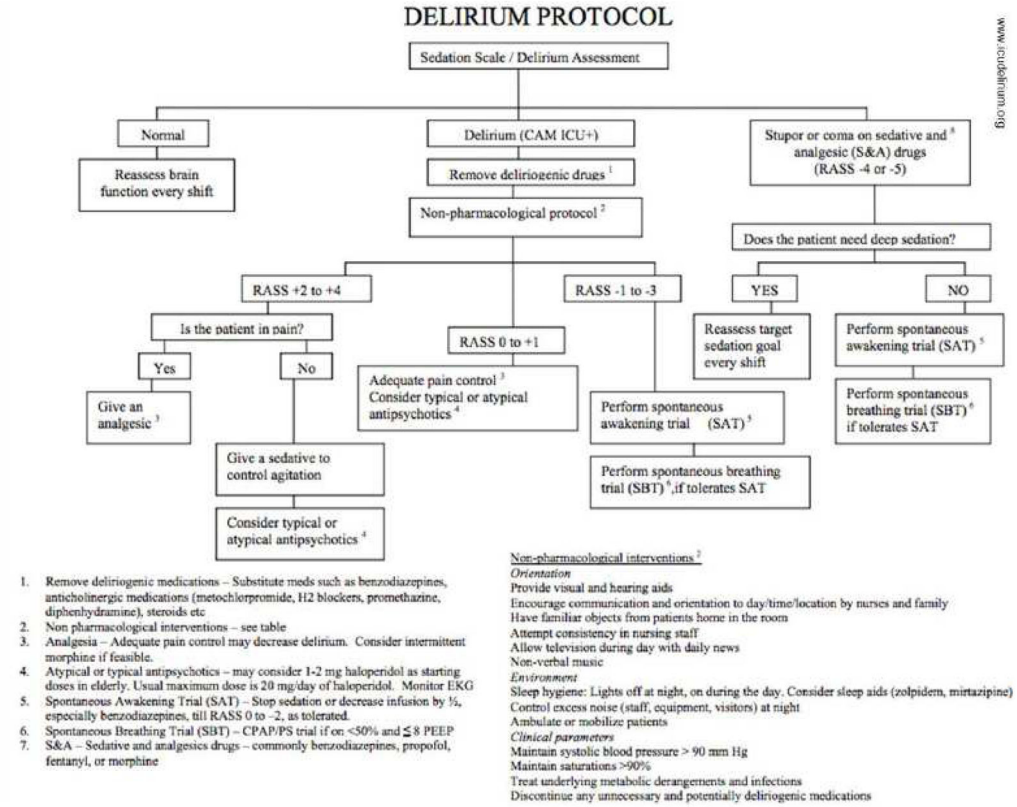

Figure 7.

Sample Delirium Protocol.

From ICU Delirium, Vanderbilt University. Available at www.ICUdelerium.org.