Pain, Agitation, Delirium, and Immobility in the ICU

1

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Introduction

Historically in critical care practice, patients were deeply sedated while receiving mechanical ventilation. This practice developed as a necessary need for patients to maintain synchrony with older versions of mechanical ventilators [1]. Along with significant technological advancements in respiratory therapy, a discriminatory approach is prudent in determining when critically ill patients have a clinical indication for continuous, deep sedation, such as refractory intracranial hypertension or certain types of severe acute respiratory failure. Sedation requirements can vary between patients depending on clinical circumstances; however, targeting lighter levels of sedation has been shown to lead to better patient outcomes [2–7].

Current pain, agitation, and delirium (PAD) evidence-based guidelines from the Society of Critical Care Medicine (SCCM) direct the practice of targeted "light" sedation, incorporating an analgesia-first approach, spontaneous awakening trials, the judicious use of non-benzodiazepine sedatives for symptoms refractory to analgesia, and non-pharmacologic means to alleviate discomfort and minimize delirium [7]. Translating evidence into daily practice can be challenging. Using patient-centered approaches that aim to empower patients and their surrogates to express their symptoms more precisely, the potential exists to simultaneously relieve unintentional suffering and improve ICU outcomes. The Institute for Healthcare (IHI) developed the concept of practice bundles to help providers deliver the best care for patients. Bundles are small, straightforward sets of evidence-based practices, when performed collectively and reliably have been shown to improve patient outcomes. Past examples include central line insertion and ventilator bundles [8].

The "ABCDEF bundle" is a mnemonic for a structure that can be used to operationalize the SCCM PAD guidelines into clinical practice (see Table 1.1). The ABCDEF bundle is evidence based and aimed to promote the best patient outcomes [9, 10]. The "A" is to assess, prevent, and manage pain first. The "B" represents coordination of spontaneous awakening trials and spontaneous breathing trials. The "C" is for appropriate choice and titration of sedation and analgesia. The "D" is for the assessment, prevention, and management of delirium. The "E" is for early mobility and exercise. The "F" is for family engagement and empowerment. Each concept has a scientific background that will be discussed in detail throughout this chapter.

Research Background

Thomas Petty, a research pioneer in pulmonary medicine, and past president of the American College of Physicians, wrote in a 1998 article entitled *Suspended life or extending death*, "what I see these days are paralyzed, sedated patients, lying without motion, appearing to be dead except for monitors that tell me otherwise" [11]. This quote represents Dr. Petty's recognition and intellectual inquiry of critical care practice that enhances deep sedation and prolonged bed rest. At the same time, research by Kollef et al. [12] showed an association of continuous sedative infusions with prolongation of mechanical ventilation [12]. This study set the foundation for a multitude of high-quality randomized controlled trials that continue to lead current practice changes in the management of pain, agitation, and delirium in critically ill patients.

Kress et al. [2] conducted the landmark randomized controlled trial that investigated the effects of decreased sedative use in 128 medical ICU patients and the first experimental research design to study an intervention called a "spontaneous awakening trial" [2]. The intervention required the spontaneous stopping of all continuous sedative infusions autonomously by the clinical nurse, once a day, to evaluate

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Table 1.1 Society of Critical Care Medicine: ABCDEF bundle

A	Assess prevent and manage pain
B	Both spontaneous awakening trials and spontaneous breathing trials to achieve light sedation levels and weaning from mechanical ventilation
C	Choice of analgesia and sedation
D	Delirium assessment, prevention, and management
E	Early mobility and exercise
F	Family engagement and empowerment

the patient's need for continued infusion of sedatives. If the patient did not tolerate the removal of sedation as evident by hemodynamic instability, or extreme agitation with risk to safety, then the medication was restarted at half the previous dose. In this trial the use of spontaneous awakening trials was shown to decrease cumulative doses of sedative medications, which resulted in 2.4 days less of mechanical ventilation and 3.5 days less in ICU length of stay. Unplanned extubations (i.e., premature removal of device) were the same in each study group.

In follow-up to the Kress et al. [2] study, Girard et al. [3] conducted a randomized controlled trial that combined the coordinated interventions of "spontaneous awakening trials" and "spontaneous breathing trials". All continuous sedatives were stopped once a day, and the patients were trialed on minimal ventilator support using "pressure support" to assess for breathing effort and efficiency [3]. This study is well known as the ABC wake-up and breathe trial because the "A" represents spontaneous awakening trials, the "B" represents spontaneous breathing trials, and the "C" represents the coordination of the interventions. Similar to results shown by Kress et al. [2], this study showed less cumulative use of benzodiazepines, 3.1 higher ventilator-free days, and a 4-day decrease in ICU length of stay in patients who received the intervention. There were more patients in the intervention group with unplanned extubations. The number of patients who required re-intubation, however, was similar between groups suggesting that the patients with unplanned extubations may have had a delay in assessment for earlier removal of the endotracheal tube.

In 2009, Schweickert et al. studied the connection between sedation, delirium, and immobility in ICU mechanically ventilated patients [4]. This was a multicenter, randomized controlled study that evaluated the use of spontaneous awakening trials, spontaneous breathing trials, and the outcomes of aggressive early physical activity of mechanically ventilated ICU patients. Patients with aggressive therapy received physical and occupational therapy 1.5 days after starting mechanical ventilation treatment. The control group received the standard physical and occupational therapy that started 7.4 days after starting mechanical ventilation treatment. Patients in the intervention group had 2 days less of delirium and 2.7 days less of mechanical ventilation. No unplanned extubations were encountered in this study. Fifty-nine percent of patients in the intervention group compared with 35 % in the control group returned to their baseline functional status at hospital discharge. The authors concluded that sedative-induced immobility is a preventable contributor to ICU-acquired weaknesses.

Analgo-sedation is a strategy of using only pain medication for sedation, without benzodiazepines, to provide comfort for mechanically ventilated patients. In 2010, Strom et al. conducted a randomized controlled trial evaluating the effect of a "no-sedation" ICU protocol [5]. This was the first trial to compare the use of intermittent opioid and short-acting hypnotic agents in a benzodiazepine-free sedation protocol. The control group received continuous short-acting hypnotic agents followed by continuous infusions of benzodiazepines and intermittent morphine. The no-benzodiazepine group had 4.2 more ventilator-free days, 9.7 fewer ICU days, and 24 fewer total hospital days. There was no difference in unplanned extubations between groups. In this study, additional resource persons acted as patient sitters and were used throughout the study for providing comfort to the patients and may have served as medical monitors to trigger nursing intervention.

In 2012, a randomized controlled trial compared the use of a sedation protocol with spontaneous awakening trials to a control group without the use of spontaneous awakening trials [6]. The intervention group received less benzodiazepines and opioids, but the overall results show no difference in days of mechanical ventilation, rates of delirium, or length of ICU stay. There was no significant difference in unplanned extubation rates between groups. A subgroup analysis of the trauma and surgical population resulted in an average of 7 days less on mechanical ventilation. A significant weakness in the study is that the stated adherence to the sedation protocol with spontaneous awakening trials was only 72 %. An important clinical finding from the study was that although spontaneous awakening trials were not strictly adhered to, a focus on a structured process for sedation choice in the ICU resulted in lower cumulative amounts of sedative in both patient groups.

Augustus and Ho [13] published a review of randomized controlled trials comparing a practice that uses continuous sedative infusions combined with daily spontaneous awakening trials to a practice that uses continuous sedative infusions and a physician-driven daily decreases in the sedative infu-

sions as desired. The review includes five studies and a total of 699 patients in the meta-analysis [13]. The summary of the meta-analysis concludes there are similar reductions in cumulative sedative exposure, and no significant difference in the ventilator days, or ICU length of stay between the groups. In conclusion, either interventions of using spontaneous awakening trials or targeted light sedation strategies are shown to reduce sedative exposure and therefore may reduce the complications of the cumulative effects of oversedation.

The challenge of any practice protocol is translation within the clinical setting. National survey data have demonstrated that many providers identify the availability of practice guidelines and sedation protocols within their institutions but self-report challenges of low adherence, inconsistent use of ICU assessment tools, and gaps in communication between caregivers [1, 14]. Only 60 % of critical care units in the USA report instituting a protocol for sedation and analgesia, and those with protocols self-report variable compliance [15, 16].

One example of a descriptive study includes the distribution of surveys to 41 North American hospitals and the American Thoracic Society e-mail database [17]. Eighty-eight percent of hospitals report using validated sedation assessment tools, and only 50 % use validated delirium screening tools. Research shows that despite the reported use of validated sedation tools, clinicians typically prescribe target sedation levels only 24.9 % of the time, and only 34.7 % of the patients actually met the prescribed target [17, 18]. Physician and nursing assessment behaviors interestingly show that even when patients are minimally arousable, these patients are being judged as oversedated only 2.6 % of the time [18]. Personal beliefs about adequate sedation have been described to effect actual provider choices in medication and the desired level of sedation of the mechanically ventilated patients [14, 19–21].

Pain, Agitation, and Delirium Assessment Scales

Valid and reliable tools are recommended for the evaluation of pain, agitation, and delirium [7]. Multiple research protocols using validated pain and sedation scales with targeted "light levels" of sedation have been shown to maintain patient comfort while decreasing practice variation and cumulative sedative exposure [22–24]. Using assessment tools decreases subjective evaluation and allows for an objective framework when assessing pain, agitation, and delirium. The use of a common language allows for providers to promote goal-directed therapy. Similar to titrating medications for blood pressure and mean arterial blood pressure (MAP) goals, valid and reliable tools for pain, agitation, and delirium should guide pharmacologic treatment parameters.

Pain

Adult ICU patients routinely experience pain not only related to surgical procedures but during routine nursing care and at rest [25–27]. All healthcare professionals should be patient advocates for effective pain control. The "A" in the ABCDEF bundle exemplifies the importance of prioritizing pain management for all critically ill patients. For patients with a deep level of sedation, assessment for pain and delirium is limited, leading to a potential delay in recognition and treatment [1, 28, 29]. This is important because unrecognized, uncontrolled pain has been shown to be a risk factor for the development of delirium, and both early ICU deep sedation levels and delirium have been shown to be predictors of mortality [29–31].

Vital signs should not be used alone as an indicator of pain but are a cue to continue with an in-depth evaluation [27, 32]. Because pain is subjective by nature, patient self-report of pain level using a numeric pain score (NPS) is considered the gold standard of practice. When patients are unable to self-report pain, the most valid and reliable behavioral scales for monitoring of pain are the Critical Care Pain Observation Tool (CPOT) and the Behavioral Pain Score (BPS) (see Tables 1.2 and 1.3). According to the SCCM PAD guidelines, the CPOT and the BPS have good inter-rater reliability, discriminant validity, and criterion validity when evaluated against four other pain scales. A CPOT score of greater than two has a sensitivity of 86 % and specificity of 78 % for predicting the presence of pain [32]. A BPS of greater than 5 is the score indicative of the presence of pain [33].

Opioids are a mainstay of treatment for pain in critical care [17]. A variety of medications may be used as alternatives or adjuncts to opioid administration. Some examples include nonsteroidal anti-inflammatory drugs, acetaminophen, or anticonvulsants [25]. Non-pharmacological complimentary

Table 1.2 Behavioral Pain Scale (BPS); range 0–12, goal ≤5

Items	Description	Score
Facial expression	Relaxed	1
	Partially tightened (eyelids lowered)	2
	Fully tightened (eyelid closing)	3
	Grimace	4
Upper limbs	No movement	1
	Partially bent	2
	Fully bent with finger flexion	3
	Permanently retracted	4
Compliance with mechanical ventilation	Tolerating movement	1
	Coughing but mostly tolerating ventilation	2
	Fighting ventilator	3
	Unable to control ventilation	4

Reproduced with permission from Payen et al. [33]

interventions may include music or relaxation therapies; pet therapy, massage, acupressure, acupuncture, and aromatherapy are underexplored in the ICU by comparison.

Agitation-Sedation

Providers commonly use the word "agitation" to describe hyperactive patient behaviors [34]. Synonyms include disquiet and unrest. In the ICU, "agitation" covers a broad range of patient signs and symptoms from mildly restless behavior to dangerously thrashing about in the bed. It is important to adopt a standard validated tool for assessing a patient's level of agitation and sedation. This will allow for a common taxonomy when describing patient behavior and assist in developing an appropriate treatment plan.

The Richmond Agitation-Sedation Scale (RASS) [35] and the Riker Sedation-Agitation Scale (SAS) [36–38] are considered the most valid and reliable scales for assessing quality and depth of sedation in ICU patients (Table 1.4). According to the SCCM PAD guidelines, the RASS and the SAS yield the highest psychometric scores when reviewed against eight other subjective sedation scales reported in the literature [7]. Psychometric scores are based upon content validation, inter-rater reliability, discriminant validation, feasibility and directive of use, and relevance in clinical practice for goal-directed therapy. The goal of an agitation-sedation scale is to evaluate level of consciousness, but there is a limitation in determining the presence of acute delirium.

Table 1.3 Components of the Critical Care Pain Observation Tool (CPOT); range 0–8, goal ≤3

Indicator	Score
Facial expression	Relaxed, neutral = 0
	Tense = 1
	Grimacing = 2
Body movements	Absence of movements = 0
	Protection = 1
	Restlessness = 2
Muscle tension Evaluated by passive flexion and extension of upper extremities	Relaxed = 0
	Tense, rigid = 1
	Very tense or rigid = 2
Compliance with the ventilator (intubated patients)	Tolerating ventilator or movement = 0
	Coughing but tolerating = 1
	Fighting ventilator = 2
Vocalization (extubated patients)	Talking in normal tone or no sound = 0
	Sighing, moaning = 1
	Crying out, sobbing = 2

Modified from Gelinas and Johnston [27]

Delirium

In 2001, two ICU delirium assessment tools called the Confusion Assessment Method for the ICU (CAM-ICU) [39] and the Intensive Care Delirium Screening Checklist (ICDSC) [40] gained recognition. Ely et al. from Vanderbilt University conducted the original validation study for the CAM-ICU [39] (see Fig. 1.1). Bergeron et al. from the University of Montreal conducted the original validation study for the ICDSC tool [40] (see Fig. 1.2). Currently there are a total of nine validation studies for the CAM-ICU with

Table 1.4 Comparison of the RASS and the SAS

	Richmond Agitation-Sedation Scale (RASS) [35]	Riker Sedation-Agitation Scale (SAS) [36]
Agitation	(4) Combative, violent, immediate danger to self	(7) Dangerous, pulling at ET tube, trying to remove catheters, climbing over bedrail, striking at staff, thrashing side to side
	(3) Very agitated pulls to remove tubes or catheters; aggressive	(6) Very agitated requiring restraint and frequent reminding of limits, biting ETT
	(2) Agitated frequent non-purposeful movement, fights ventilator	(5) Agitated anxious or physically agitated, calms to verbal instructions
	(1) Restless anxious, apprehensive, movements not aggressive	
Awake and calm	(0) Spontaneously pays attention to caregiver	(4) Calm and cooperative easily arousable, follows commands
	(−1) Drowsy but sustained eye contact ≥10 s	
Sedation	(−2) Light sedation briefly awakens to voice (eyes open and contact <10 s	(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)	(2) Very sedated arouses to physical stimuli but does not communicate or follow commands, may move spontaneously
	(−4) Deep sedation no response to voice but movement or eye opening to physical stimulus	
	(−5) Unarousable	(1) Unarousable
	No response to voice or physical stimulus	Minimal or no response to noxious stimuli, does not communicate or follow commands

Medscape

Confusion assessment method for the ICU (CAM-ICU) flowsheet

Delirium can only be assessed in patients more alert than RASS –3 or SAS 3

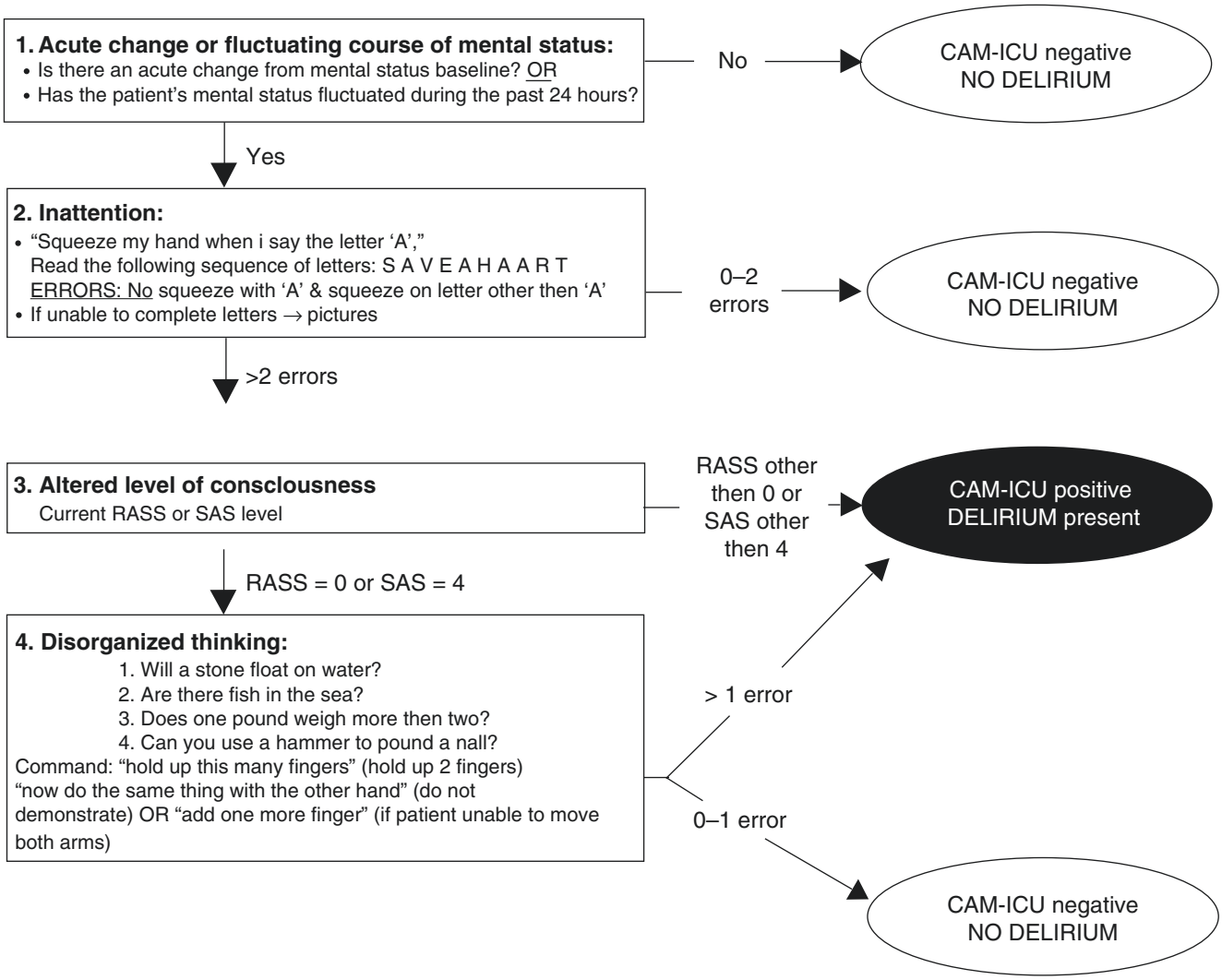

Fig. 1.1 Delirium screening: Confusion Assessment Method for the ICU (Brummel et al. [41])

a combined sample size of 969 to show the CAM-ICU having a pooled sensitivity of 80% and a specificity of 95.5% [42]. There are a total of four validation studies and a combined sample size of 391 to show the ICDSC with a sensitivity of 74% and a specificity of 81.9% [42]. The CAM-ICU is the most frequently used assessment tool for institutions that perform routine delirium monitoring [17].

The following four features are characteristic of delirium: acute onset or fluctuating course, inattention, disorganized thinking, and altered level of consciousness. According to the American Psychiatric Association [43], delirium is defined as a fluctuating disturbance of consciousness, with inattention, accompanied by a perceptual disturbance that develops over a short period (hours to days) [43]. Delirium is transient and usually reversible [44]. There are three types of delirium: hyperactive, hypoactive, and mixed. Hyperactive delirium is more easily recognizable as the symptoms include moderate to severe agitation and confusion. Hypoactive delirium is more discreet as the person appears calm and quiet and is only evident with focused interaction.

Delirium occurs in up to 50–70% of critically ill patients [30, 45]. ICU delirium, previously termed ICU psychosis, was once thought to be an inconsequential and uncontrollable

Intensive Care Delirium Screening Checklist (ICDSC)

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 = 1point Normal wakefulness [SAS = 4;RASS = 0] over the entire shift = 0 point Light sedation [SAS = 3; RASS = –1,–2,–3] = 1 point (if no recent sedatives) = 0 points (if recent sedatives)	No	0	1	Yes
2. Inattention Difficulty following instructions or conversation; esily 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, dose 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-hours period.	No	0	1	Yes
Total shift score (Min 0 - Max 8)				

Fig. 1.2 Delirium screening: Intensive Care Delirium Screening Checklist (ICDSC) (Adapted from Bergeron et al. [40])

complication of critical illness. Now both modifiable and non-modifiable risk factors are being reported in the literature. The first step is to recognize the presence of delirium though daily consistent monitoring with valid and reliable scales as described earlier. Expounding the exact etiology of delirium is a challenging component in determining appropriate management. Delirium may be disease induced such as organ dysfunction in severe sepsis; iatrogenic such as with exposure to sedatives and opioids; or environmental, related to noise, poor sleep hygiene, immobilization, and the use of physical restraints.

Predisposing risk factors for the development of delirium include but are not limited to age >65 years and the presence of a baseline cognitive disorder. Precipitating factors are multiple and include fluid and electrolyte disturbances, hypoxemia, drug withdrawal syndromes, uncontrolled pain, and polypharmacy. Figure 1.3 presents one delirium assessment algorithm for critically ill patients. Medications with a high psychoactive activity or anticholinergic potential have been associated with an increased risk of delirium [46].

Scientific research into the biological changes that underlie delirium is underway as there is poor understanding of the complex interactions between and within organ systems during delirium [44]. The following neurotransmitters that modulate the control of cognitive function, behavior, and mood may have

a role in the pathogenesis of delirium: acetylcholine, serotonin, dopamine, and gamma-aminobutyric acid [47]. Other potential causes may be related to inflammatory processes involving C-reactive protein, pro-inflammatory cytokines, or fluctuations in cortisol levels [44] or an oxidative impairment that leads to cerebral dysoxia and dysfunction [46].

Patient descriptions of ICU delirium experiences included frightening hallucinations with feelings of fear and panic. The overall themes of ICU delirium include fear, panic, fluctuations between reality and unreality, discomfort, and remorse [48]. Perhaps most importantly, these memories may persist after the delirium has cleared and impacts the incidence of the post-intensive care syndrome.

Benzodiazepines are the most frequently used sedatives to treat agitation in the ICU [17]. Lorazepam (Ativan) is a benzodiazepine that has an odds ratio of 1.2 as an independent risk factor for ICU delirium [49]. Every 1 mg dose of lorazepam in the previous 24-h period is significantly associated with a 20 % increase in the daily transition to delirium. When 20 mg or more is given in a 24-h period, there is a 100 % probability of transitioning to a delirious state. A systematic review that included 38 level III studies without a meta-analysis showed that benzodiazepines are consistently associated with an increased risk for developing delirium [50]. Other risk factors for delirium included depression, anticholinergic drugs, and age.

Delirium is associated with the non-beneficial outcomes of increased mortality and institutionalization. While there is limited randomized controlled data showing that benzodiazepines may increase ICU LOS or mortality, their use has been significantly correlated with increased rates of delirium in all adult ICU populations, regardless of predisposing risk factors [51–53]. These potentially conflicting viewpoints have been well addressed in current guidelines and recognize benzodiazepines as second-line medication for agitation-sedation [7].

Atypical antipsychotics, most notably haloperidol and quetiapine, are weakly recommended in the current SCCM guidelines as therapy for delirious patients as a means of reducing total delirium days. Only a limited number of studies have explored their use to reduce days of delirium in the ICU. Prophylactic use of atypical antipsychotics has not been shown to reduce rates of delirium in the ICU [54]. This practice is not recommended in current guidelines [7].

Non-pharmacological Approaches

Intubated patients are often frustrated by not being able to talk and communicate their thoughts and needs [14, 19]. Qualitative research with ICU survivors shows that patients become anxious when there is uncertainty regarding daily plans and moment-to-moment changes in care. Restraints and awakening to unanticipated, painful care appear to exacerbate anxiety and may precondition such a response to all care. The critical care team should develop communication skills and techniques to keep patients informed. Traditionally, patients use picture boards and write questions and comments on paper. More innovative approaches include using communication applications that are available on I-pads. Enhanced communication is enabled by reduced sedative use and the more recent emphasis on noninvasive ventilation as opposed to endotracheal intubation and mechanical ventilation.

Multicomponent non-pharmacological approaches are effective in reducing the incidence of delirium as well as falls in older non-ICU hospitalized patients [55, 56] (Fig. 1.1). Examples of non-pharmacological approaches include but are not limited to music therapy, noise reduction, exposure to natural light, and educational programs for staff. Inconclusive evidence exists for the role of non-pharmacological interventions in the treatment of ICU delirium with only limited studies that have been conducted in the ICU. Two available ICU studies conclude that treatments such as music therapy [57] and the use of earplugs [58] may be beneficial in reducing the need for sedatives. Early mobility for critically ill patients may reduce the total days of delirium in mechanically ventilated ICU patients [4].

Early Mobility

It is common for critically ill adults to have limited mobility due to deep sedation, hemodynamic instability, invasive procedures, and treatment with sophisticated lifesaving but bed tethering machines such as ECMO. One should note that such notions have been challenged and there are multiple reports of ambulating patients on mechanical ventilation coupled with ventricular assist devices. Prolonged bed rest has deleterious effects on multiple body systems [59–61]. Severe neuromotor weakness, deficits in self-care, and poor quality of life are being reported in patients for up to 5 years after discharge from the ICU [62].

Early mobilization of critically ill adults has been a focus of research over the past 10–15 years [63]. Early mobilization is not standard or clearly defined in the literature but generally refers to a process of sedation minimization along with supporting patients to first sit on the edge of the bed to sitting out of bed in chairs, standing, marching in place, and eventually ambulating [64]. Benefits of early mobilization are a reduction in hospital costs by decreasing the days of mechanical ventilation, duration of delirium, ICU length of stay, and overall hospital length of stay [4, 63, 65, 66]. Equipment to support and facilitate patient exercise in the ICU is essential to such programs.

Barriers to wide dissemination and implementation of early mobility programs include gaps in knowledge and concerns for patient safety. Providers may fear removal of invasive lines and tubes, cardiac complications, and patient falls. Multiple studies show that early mobility is both safe and

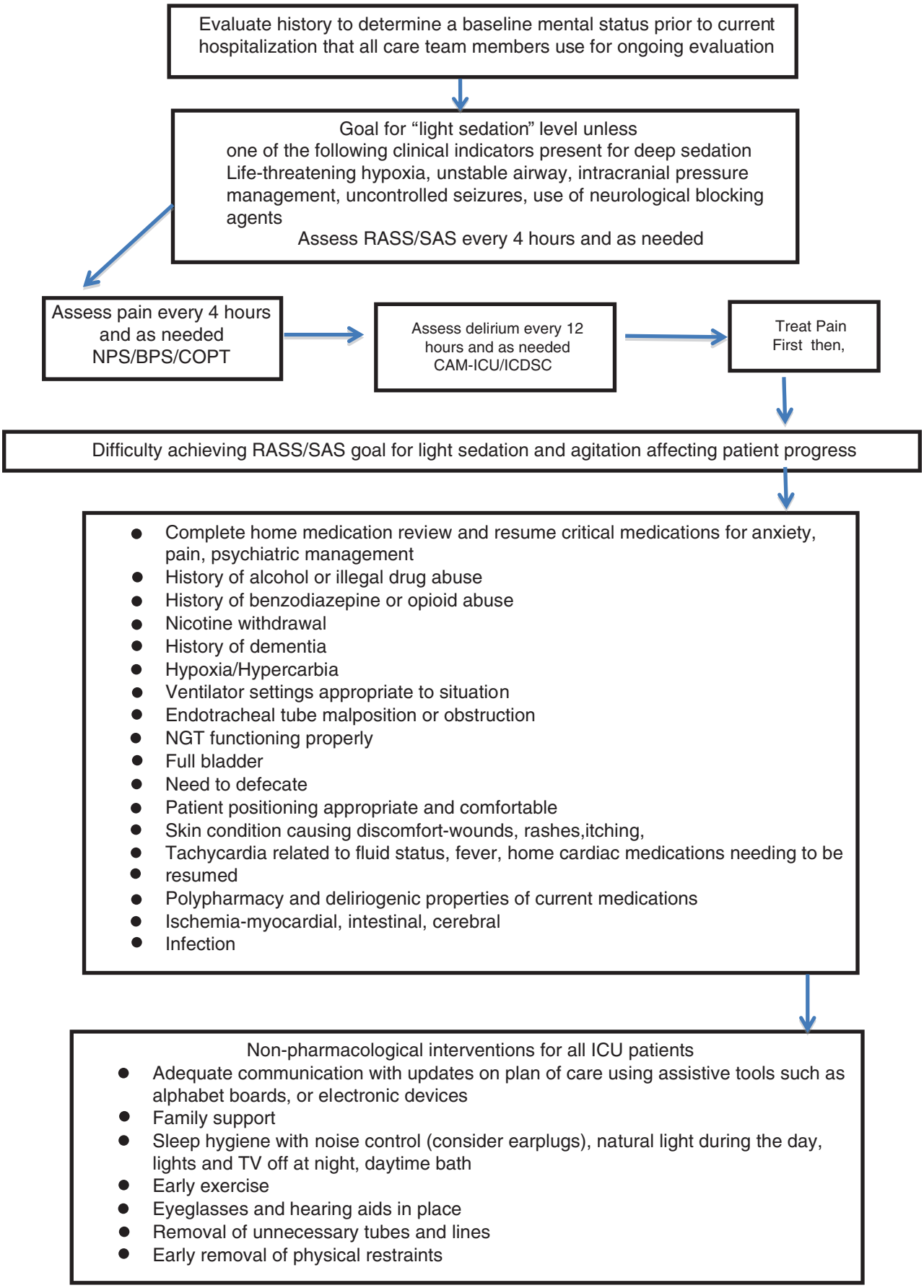

Fig. 1.3 Pain, agitation, and delirium assessment algorithm for critically ill patients

feasible [4, 67–69]. Early mobility requires a team approach with physicians, nurses, respiratory therapists, and physical and occupational therapists; family members are increasingly engaged in the process as well. Time constraints and staff resources are challenges, and therefore institutional commitment to this evidence-based therapy is necessary for programs to flourish. Table 1.5 provides evidence-based criteria for determining when to safely mobilize critically ill patients and when to consider termination of a mobility session.

Post-intensive Care Syndrome

Advanced treatments in critical care medicine are resulting in reduced mortality rates and an increasing number of survivors of critical illness [70]. ICU survivors may suffer from both physical and cognitive impairment after being discharged from acute care. About 15–35 % of patients may experience post-traumatic stress disorder (PTSD) symptoms [71, 72]. Symptoms of PTSD involve flashbacks or nightmares, avoidance behavior, or hyperarousal with irritability and difficulty sleeping. ICU survivors can experience flashbacks related to delirium causing frightening delusions or hallucinations experienced in the ICU. It is not thought to be the duration of delirium but the quality of a patient's delirious experience that is associated with later post-ICU PTSD [71]. Patients experiencing PTSD score lower on health-related quality of life scores (HRQOL) [73]. Preliminary research shows that patients who suffer from PTSD are at an increased risk of rehospitalization over the follow-up first year [72].

Post-intensive care syndrome (PICS) is a newer term used to define the compilation of new or worsening impairments in physical, cognitive, or mental health status arising after critical illness and persisting beyond acute care hospitalization [74]. This term applies not only to the burden of critical illness for individual patients but to their families (PICS-F). Increased emphasis is being directed toward improving resources and opportunities of post-hospital care for both patients and families. More collaboration is developing between critical care and community specialists in primary care, physical, and mental health. Some institutions have created post-ICU clinics to support the special needs of this population.

Symptoms of PTSD are not related to events that actually occurred and were accurately processed by the ICU patients [71]. Research findings support the use of diaries and pictures compiled throughout an ICU stay by patients and families to use during post-ICU care. This process may help to demystify delusional memories and gaps in time that appear to be lost with delusional frightening memories. This is also reinforcement of the need for critical care providers to adopt evidence-based PAD guidelines and to rethink practice where heavy sedation and ICU psychosis were previously considered the norm.

Table 1.5 Criteria for holding or terminating a physical or occupational therapy session in critically ill patients in the intensive care unit

Heart rate	>70 % age predicted maximum heart rate
	>20 % decrease in resting heart rate
	<40 beats/min, >130 beats/min
	New onset dysrhythmia
	New antiarrhythmic medication
	New MI by ECG or cardiac enzyme
Blood pressure	Systolic blood pressure >180 mmHg
	>20 % decrease in systolic/diastolic pressures
	MAP <65 mmHg, >110 mmHg
	Presence of vasopressor medications with new vasopressor need or escalating dose of vasopressor medications
Respiratory rate	<5 breaths/min or >40 breaths/min
Pulse oximetry	>4 % decrease in oxygen saturation during activity
	<88–90 % oxygen saturation
Mechanical ventilation	Fio2 requirement ≥0.60
	PEEP requirement ≥10
	Unresolved patient-ventilator asynchrony
	Mechanical mode change to assist control
	Tenuous, unstable airway
Alertness/agitation and patient symptoms	Patient deeply sedated or coma
	Patient agitation requiring addition or escalation of sedatives
	Patient complains of dyspnea on exertion
	Patient refusal

Reproduced with permission from Adler and Malone [63]

Conclusion

Practice guidelines from the Society of Critical Care Medicine (SCCM) recommend institutions implement an evidence-based ICU pain, agitation, and delirium (PAD) bundle. The evidence-based goal is to focus on systematically identifying and managing pain, agitation, and delirium in an integrated fashion. Clinicians will optimally use validated assessment tools to achieve "lighter sedation" levels and target specific, individualized treatment for pain, agitation, and delirium mitigation. Strategies for management incorporate an analgesia-first approach, the judicious use of benzodiazepine sedatives, reduction of continuous infusions, and the promotion of early mobilization. Regular development and deployment of communication techniques that facilitate recognizing and responding to patient and family needs both during the ICU stay and through convalescence may reduce the occurrence of agitation, sedation, delirium, and the post-intensive care syndrome.

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