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Articles

The Delphi Delirium Management Algorithms. A practical tool for clinicians, the result of a modified Delphi expert consensus approach.

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Delirium

Delirium is common in hospitalised patients, and there is currently no specific treatment. Identifying and treating underlying somatic causes of delirium is the first priority once delirium is diagnosed. Several international guidelines provide clinicians with an evidence-based approach to screening, diagnosis and symptomatic treatment. However, current guidelines do not offer a structured approach to identification of underlying causes.

A panel of 37 internationally recognised delirium experts from diverse medical backgrounds worked together in a modified Delphi approach via an online platform. Consensus was reached after five voting rounds. The final product of this project is a set of three delirium management algorithms (the Delirium Delphi Algorithms), one for ward patients, one for patients after cardiac surgery and one for patients in the intensive care unit.

INTRODUCTION

Delirium is an acute disorder of brain function that is caused by other medical conditions, substance intoxication or withdrawal, or exposure to a toxin. It is characterised by a disturbance in attention, a reduced level of orientation to the environment and other cognitive disturbances that cannot otherwise be explained by neurocognitive disorders.[1] Delirium can be regarded as a clinical expression of acute encephalopathy.[2] Delirium frequently occurs in hospitalised adults, and is associated with significantly increased ICU and hospital length of stay, mortality, as well as an increased risk of long-term cognitive disorders and loss of independence.[3] The economic impact of delirium is substantial. Delirium in older hospitalised adults has been estimated to cost between $38 billion and $152 billion per year.[4]

For healthcare providers, the large variety in clinical phenotypes and fluctuating clinical course of the syndrome makes screening for and diagnosing delirium notoriously difficult. Furthermore, there is no curative treatment, and the efficacy of both pharmacologic and non-pharmacologic interventions to suppress delirium symptoms is limited.[5] Healthcare providers have several practice guidelines, in-

cluding those published by the American Geriatrics Society and the Society of Critical Care Medicine (SCCM).[5,6] There are also guidelines for specific patient groups. Examples include the guideline for postoperative delirium from the European Society of Anaesthesiology.[7] Although these guidelines all clearly state how and when patients should be screened for signs and symptoms of delirium, and what potential underlying causes of delirium are, none of the guidelines provides a framework for a structured approach to detection and management of underlying causes or follow-up once delirium is diagnosed.

There are several mnemonics and acronyms that aim to support healthcare providers in detecting the underlying cause of delirium. Examples include "I WATCH DEATH" and "DELIRIOUS". However, mnemonics and acronyms often do not distinguish for what population they are intended, when and how to use the information they provide, and who developed the mnemonic.(ICU Delirium.Org, retrieved Aug 4, 2023) They also make no distinction between rare and common underlying causes of delirium, or suggest what priority should be given to the individual items.

The prevention, monitoring and treatment of delirium receives an increasing amount of attention. This is due to several factors, including evidence-based practice initiatives like SCCM's ICU Liberation Project, as well as the arrival of simplified electroencephalography (EEG) devices that can assist in detecting the underlying EEG changes that are seen in acute encephalopathies underlying delirium.[8,9] These innovations increase the demand for a structured framework on how to approach patients who are diagnosed with possible delirium.

This paper describes an initiative to create a clinical algorithm to provide healthcare providers with a structured approach to hospitalised patients who develop delirium.

METHODS

In December 2020, the initiators of this project (TO, CH and AJCS) convened for the first time to discuss the existing gap in guidance for healthcare providers caring for hospitalised patients with delirium. We outlined a simple, stepwise "template algorithm" that emphasised a structured approach to detecting underlying causes of delirium, followed by suggestions for symptomatic treatments and follow-up. Model content was based on international delirium guidelines[5,7,8] systematic reviews on underlying causes and triggers of delirium[10,11] and mnemonics found in diverse sources (see table 1).[12] We followed a modified Delphi approach to reach expert consensus on the contents of this model, referred to as "the Delirium Delphi Algorithms".

With attention to diversity in training, gender and nationality, we invited a group of experts to form the interdisciplinary consensus panel. We invited 38 experts to participate. Because of the COVID-19 pandemic, the consensus process took place online. Panel members were presented with concept versions of the algorithms and were asked to respond to design elements (such as the order in which suggestions were presented), text statements (such as: *All patients should receive preventive non-pharmacologic measures, regardless of their cognitive state*) and could comment on specific textual content. Responses were gathered dichotomously (agree/disagree) and in full-text comments. The online consensus process allowed the Panel members to comment and vote privately, at their own pace.

After each voting round, the responses and comments of the Panel were discussed within the Board. The agreement between Panel members with each design choice, statement or other item offered for voting was calculated by dividing the number of members who agreed by the number of respondents to that particular voting round. Before the start of data collection, we agreed that 85% of agreement needed to be reached within the panel before a statement or design element would be consolidated in the algorithm. Elements or statements with a lower agreement level were adjusted using comments from panel members. The updated version of the algorithm was then offered to the Panel in a new voting round. Items that already reached a high level of agreement were not offered for voting again.

A report with the agreement levels and a motivation for each proposed adjustment to the algorithms was sent to the Panel members before the next voting round.

RESULTS

In total, 38 experts agreed to participate; 37 completed at least one voting assignment (response rate 97%). TO, CH and AJCS acted as a board. Panel members had a background in anaesthesiology (5), cardiac surgery (1), geriatrics (9), intensive care medicine (7), neurology (5), nursing (4), pharmacy (1) and psychiatry and psychology (6) and practice their profession in the United States of America, Australia, Austria, Belgium, Canada, Denmark, Germany, Italy, The Netherlands, Poland, and the United Kingdom (Supplementary Material). All panel members signed the digital participation agreement before completing the first voting assignment. The voting rounds took place between June 2021 and January 2023. The panel required five voting rounds to reach consensus about the set of algorithms (Table 2).

The final product of this process is a set of three algorithms: one for patients in hospital wards, one for patients after cardiac surgery, and one for patients in intensive care units. To improve usability, the content of the algorithms was kept concise. The algorithms share a set of five "reference cards", which contain more detailed information, such as suggestions for non-pharmacologic interventions. The full set of three algorithms and 5 reference cards, as well as an instruction for users, is presented in the Additional File 2. As an example, the algorithm version for patients in normal hospital wards is shown in Figure 1a. The reference card for non-pharmacologic interventions is presented in Figure 1b.

A detailed record of the modified Delphi voting process is presented in Additional File 1.

Table 1. Five well-known mnemonics for potential underlying causes of delirium.

"I WATCH DEATH"		"DELIRIOUS"		"DELIRIUM(S)"	
Cue	Meaning	Cue	Meaning	Cue	Meaning
I	**I**nfection (HIV, sepsis, pneumonia)	D	**D**rugs (Continuous drips, Na+, Ca+, BUN/ Creatinine, NH3+)	D	**D**rugs
W	**W**ithdrawal (alcohol, barbiturate, sedative-hypnotic)	E	**E**nvironmental factors (hearing aids, eye glasses, sleep/wake cycle)	E	**E**yes, ears, and other sensory deficits
A	**A**cute metabolic (acidosis, alkalosis, electrolyte disturbance, hepatic failure, renal failure)	L	**L**abs (including Na+, K+, Ca+, BUN/Cr, NH3+)	L	**L**ow O2 states (e.g. heart attack, stroke, and pulmonary embolism)
T	**T**rauma (closed-head injury, heat stroke, postoperative, severe burns)	I	**I**nfection	I	**I**nfection
C	**C**NS pathology (Abscess, hemorrhage, hydrocephalus, subdural hematoma, infection, seizures, stroke, tumors, metastases, vasculitis, encephalitis, meningitis, syphilis)	R	**R**espiratory status (ABGs-PaO2 and PCO2)	R	**R**etention (of urine or stool)
H	**H**ypoxia (anemia, carbon monoxide poisoning, hypotension, pulmonary or cardiac failure	I	**I**mmobility	I	**I**ctal state
D	**D**eficiencies (vitamin B12, folate, niacin, thiamine)	O	**O**rgan failure (renal failure, liver failure, heart failure)	U	**U**nderhydration/ undernutrition
E	**E**ndocrinopathies (hyper/hypoadrenocorticism, hyper/ hypoglycemia, myxedema, hyperparathyroidism)	U	**U**nrecognised dementia	M	**M**etabolic causes (Diabetes, post-operative state, sodium abnormalities)
A	**A**cute vascular (Hypertensive encephalopathy, stroke, arrhythmia, shock)	S	**S**hock (sepsis, cardiogenic)/steroid	(S)	**S**ubdural hematoma
T	**T**oxins or drugs (prescription drugs, illicit drugs, pesticides, solvents)				
H	**H**eavy metals (lead, manganese, mercury)				

"THINK"		"DR. DRE"	
Cue	Meaning	Cue	Meaning
T	**T**oxic Situations: CHF, shock, dehydration, delirogenic medication, new organ failure (liver, kidney)	Dr.	**D**iseases (Sepsis, COPD, CHF)
H	**H**ypoxemia	Dr	**Dr**ug removal (spontaneous awakening trials, stopping benzodiazepines/ narcotics)
I	**I**nfection/sepsis (nosocomial), Immobilization	E	**E**nvironment (Immobilisation, sleep and day/night, hearing aids, glasses)
N	**N**on-pharmacological interventions Hearing aids, glasses, re-orient, sleep protocols, music, noise control, ambulation		
K	**K**+, Electrolyte problems		

Abbreviations: ABG, Arterial Blood Gas; BUN, Blood Urea Nitrogen; CHF, Congestive Heart Failure; CNS, Central Nervous System; HIV, Humane Immunodeficiency Virus;

DISCUSSION

Using a modified Delphi approach, we developed a set of algorithms to support healthcare providers who take care of hospitalised adult patients with delirium. In five online voting rounds, consensus was reached between a diverse group of 37 internationally recognised delirium experts.

POSITION RELATIVE TO GUIDELINES

The Delirium Delphi Algorithms intend to provide structure and prioritisation, and strongly focus on identifying modifiable precipitating factors. As such, these are intended to be used as a tool, in addition to national and international guidelines. The content is primarily based on expert opinion and should be regarded as such. Users are advised to take their local situation into account and always comply with local legislation, particularly when it comes to involuntary medical treatments such as the use of restraints.

Table 2.Voting Rounds and Response Rates

Voting round	Topic	Response Rate
1	Statements and structure	35/37 (94.6%)
2	Blueprint algorithm (ward patients) and first reference cards	35/37 (94.6%)
3	Improved version of blueprint algorithm and reference cards	32/37 (86.5%)
4	Algorithm versions for cardiac surgery and ICU population	29/37 (78.4%)
5	Final algorithm set, endorsement	37/37 (100%)

KNOWLEDGE GAP

There is currently no high-quality evidence available to support one particular approach to management of delirium and its underlying causes. The application of the Delirium Delphi Algorithms implies a bundle of several "good clinical practices". These include structured application of non-pharmacologic interventions to prevent delirium, a strong focus on the identification of modifiable precipitating factors, and follow-up that consists of frequent re-assessment of the patient's need for symptomatic drug treatments. Bundles of interventions have repeatedly been proven to be more effective in reducing the delirium burden than standalone interventions.[13]

FUTURE OF DELIRIUM MANAGEMENT

With the arrival of innovations in delirium screening and monitoring as well as individualised interventional treatments, the field of delirium management is likely to change significantly in the next ten years. The algorithms will be kept up to date by the authors to follow these develop- ments. We encourage healthcare providers who regularly treat patients with delirium to form interdisciplinary work- ing groups in their institution to keep their delirium man- agement strategies up-to-date.

CONCLUSION

We present a set of algorithms to support healthcare providers caring for hospitalised adult patients with delirium.

FUNDING

This project has not received funding.

DISCLOSURES

The authors have no conflicts of interest to disclose.

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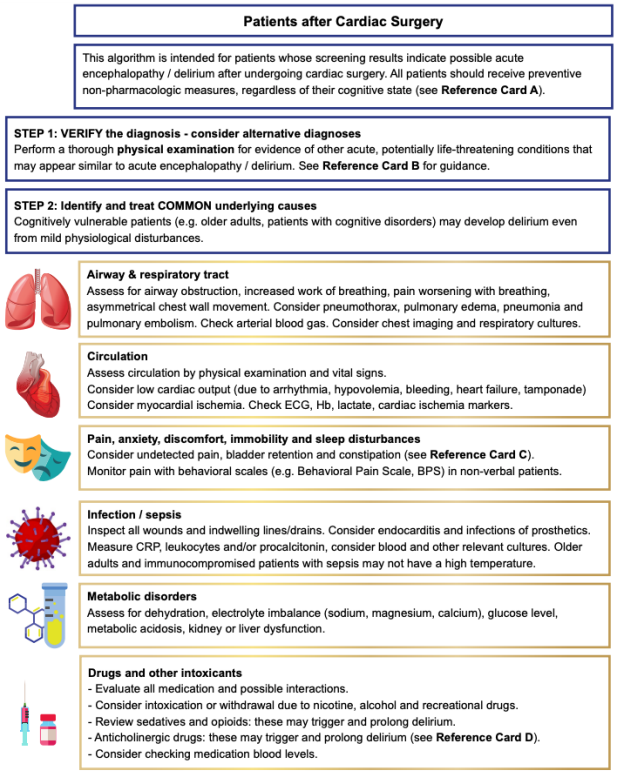
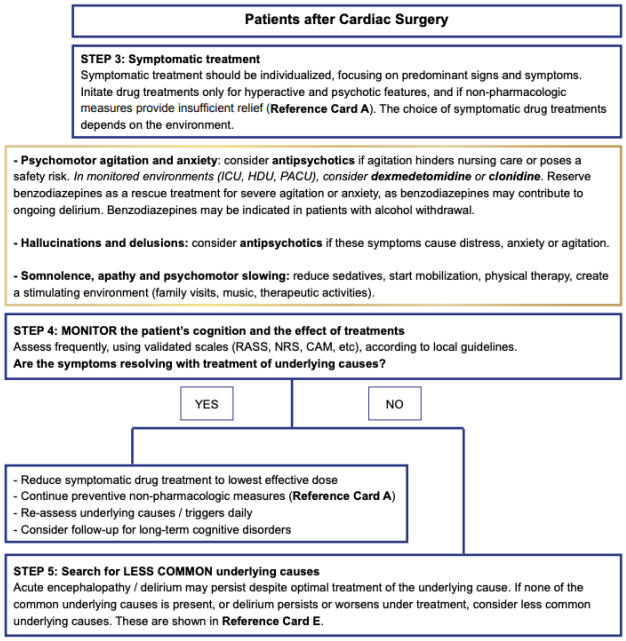




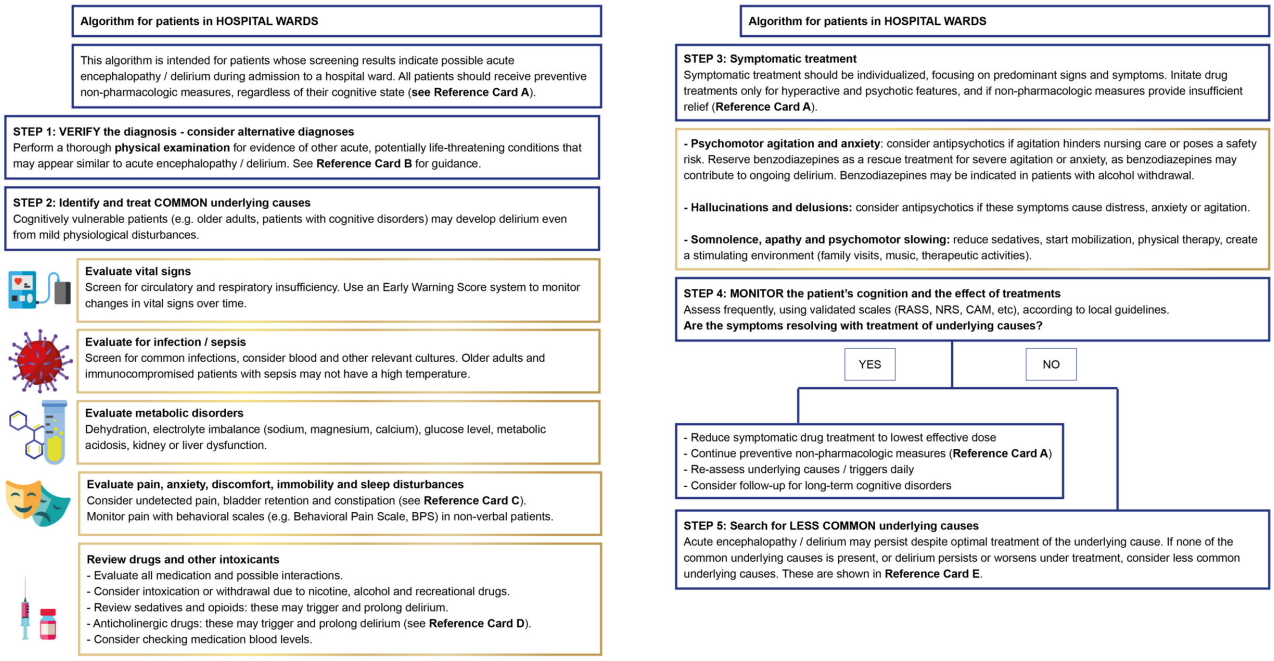
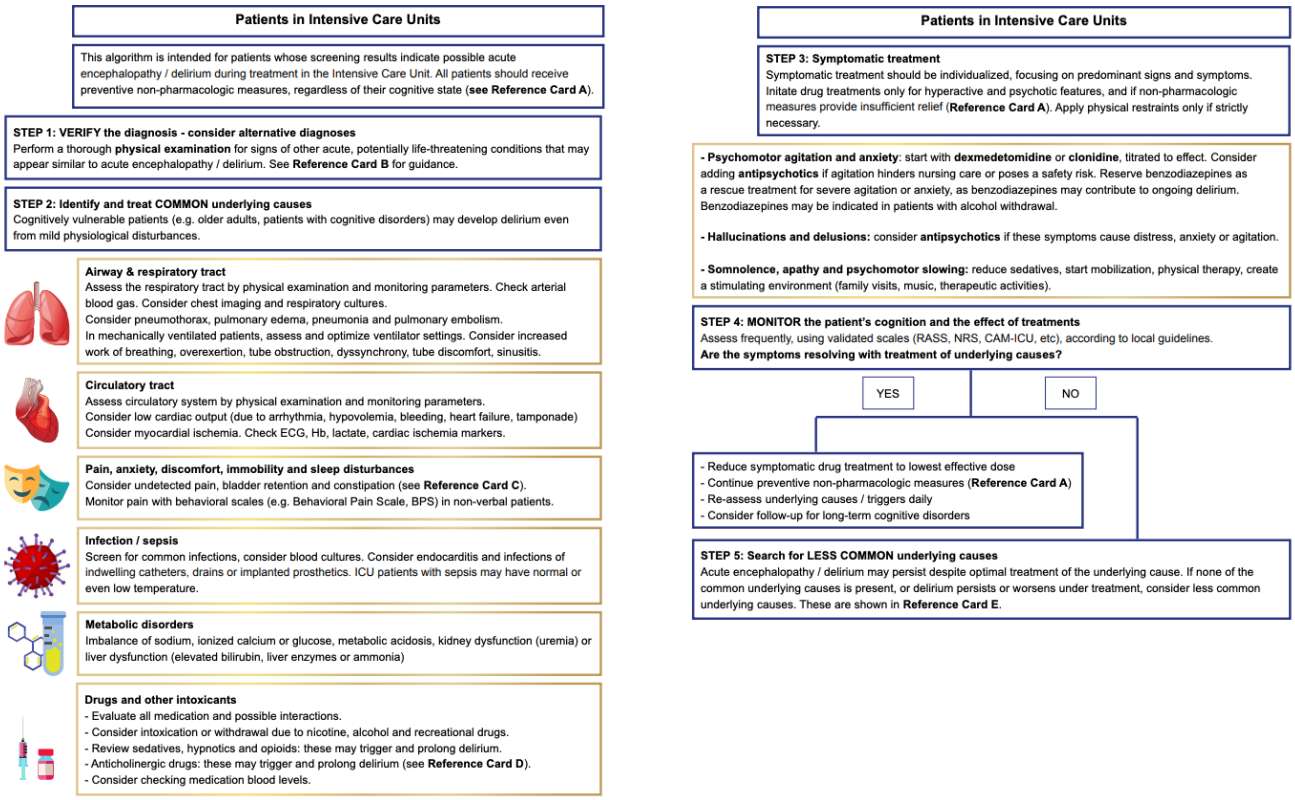

Algorithm for patients in HOSPITAL WARDS
This algorithm is intended for patients whose screening results indicate possible acute encephalopathy / delirium during admission to a hospital ward. All patients should receive preventive non-pharmacologic measures, regardless of their cognitive state (see Reference Card A).
STEP 1: VERIFY the diagnosis - consider alternative diagnoses
Perform a thorough physical examination for evidence of other acute, potentially life-threatening conditions that may appear similar to acute encephalopathy / delirium. See Reference Card B for guidance.
STEP 2: Identify and treat COMMON underlying causes
Cognitively vulnerable patients (e.g. older adults, patients with cognitive disorders) may develop delirium even from mild physiological disturbances.
Evaluate vital signs
Screen for circulatory and respiratory insufficiency. Use an Early Warning Score system to monitor changes in vital signs over time.
Evaluate for infection / sepsis
Screen for common infections, consider blood and other relevant cultures. Older adults and immunocompromised patients with sepsis may not have a high temperature.
Evaluate metabolic disorders
Dehydration, electrolyte imbalance (sodium, magnesium, calcium), glucose level, metabolic acidosis, kidney or liver dysfunction.
Evaluate pain, anxiety, discomfort, immobility and sleep disturbances
Consider undetected pain, bladder retention and constipation (see Reference Card C).
Monitor pain with behavioral scales (e.g. Behavioral Pain Scale, BPS) in non-verbal patients.
Review drugs and other intoxicants
- Evaluate all medication and possible interactions.
- Consider intoxication or withdrawal due to nicotine, alcohol and recreational drugs.
- Review sedatives and opioids: these may trigger and prolong delirium.
- Anticholinergic drugs: these may trigger and prolong delirium (see Reference Card D).
- Consider checking medication blood levels.
Algorithm for patients in HOSPITAL WARDS
STEP 3: Symptomatic treatment
Symptomatic treatment should be individualized, focusing on predominant signs and symptoms. Initate drug treatments only for hyperactive and psychotic features, and if non-pharmacologic measures provide insufficient relief (Reference Card A).
- Psychomotor agitation and anxiety: consider antipsychotics if agitation hinders nursing care or poses a safety risk. Reserve benzodiazepines as a rescue treatment for severe agitation or anxiety, as benzodiazepines may contribute to ongoing delirium. Benzodiazepines may be indicated in patients with alcohol withdrawal.
- Hallucinations and delusions: consider antipsychotics if these symptoms cause distress, anxiety or agitation.
- Somnolence, apathy and psychomotor slowing: reduce sedatives, start mobilization, physical therapy, create a stimulating environment (family visits, music, therapeutic activities).
STEP 4: MONITOR the patient's cognition and the effect of treatments
Assess frequently, using validated scales (RASS, NRS, CAM, etc), according to local guidelines.
Are the symptoms resolving with treatment of underlying causes?
YES
NO
- Reduce symptomatic drug treatment to lowest effective dose
- Continue preventive non-pharmacologic measures (Reference Card A)
- Re-assess underlying causes / triggers daily
- Consider follow-up for long-term cognitive disorders
STEP 5: Search for LESS COMMON underlying causes
Acute encephalopathy / delirium may persist despite optimal treatment of the underlying cause. If none of the common underlying causes is present, or delirium persists or worsens under treatment, consider less common underlying causes. These are shown in Reference Card E.

Figure 1a.


Patients in Intensive Care Units
This algorithm is intended for patients whose screening results indicate possible acute encephalopathy / delirium during treatment in the Intensive Care Unit. All patients should receive preventive non-pharmacologic measures, regardless of their cognitive state (see Reference Card A).
STEP 1: VERIFY the diagnosis - consider alternative diagnoses
Perform a thorough physical examination for signs of other acute, potentially life-threatening conditions that may appear similar to acute encephalopathy / delirium. See Reference Card B for guidance.
STEP 2: Identify and treat COMMON underlying causes
Cognitively vulnerable patients (e.g. older adults, patients with cognitive disorders) may develop delirium even from mild physiological disturbances.
Airway & respiratory tract
Assess the respiratory tract by physical examination and monitoring parameters. Check arterial blood gas. Consider chest imaging and respiratory cultures.
Consider pneumothorax, pulmonary edema, pneumonia and pulmonary embolism.
In mechanically ventilated patients, assess and optimize ventilator settings. Consider increased work of breathing, overexertion, tube obstruction, dyssynchrony, tube discomfort, sinusitis.
Circulatory tract
Assess circulatory system by physical examination and monitoring parameters.
Consider low cardiac output (due to arrhythmia, hypovolemia, bleeding, heart failure, tamponade)
Consider myocardial ischemia. Check ECG, Hb, lactate, cardiac ischemia markers.
Pain, anxiety, discomfort, immobility and sleep disturbances
Consider undetected pain, bladder retention and constipation (see Reference Card C).
Monitor pain with behavioral scales (e.g. Behavioral Pain Scale, BPS) in non-verbal patients.
Infection / sepsis
Screen for common infections, consider blood cultures. Consider endocarditis and infections of indwelling catheters, drains or implanted prosthetics. ICU patients with sepsis may have normal or even low temperature.
Metabolic disorders
Imbalance of sodium, ionized calcium or glucose, metabolic acidosis, kidney dysfunction (uremia) or liver dysfunction (elevated bilirubin, liver enzymes or ammonia)
Drugs and other intoxicants
- Evaluate all medication and possible interactions.
- Consider intoxication or withdrawal due to nicotine, alcohol and recreational drugs.
- Review sedatives, hypnotics and opioids: these may trigger and prolong delirium.
- Anticholinergic drugs: these may trigger and prolong delirium (see Reference Card D).
- Consider checking medication blood levels.
Patients in Intensive Care Units
STEP 3: Symptomatic treatment
Symptomatic treatment should be individualized, focusing on predominant signs and symptoms. Initate drug treatments only for hyperactive and psychotic features, and if non-pharmacologic measures provide insufficient relief (Reference Card A). Apply physical restraints only if strictly necessary.
- Psychomotor agitation and anxiety: start with dexmedetomidine or clonidine, titrated to effect. Consider adding antipsychotics if agitation hinders nursing care or poses a safety risk. Reserve benzodiazepines as a rescue treatment for severe agitation or anxiety, as benzodiazepines may contribute to ongoing delirium. Benzodiazepines may be indicated in patients with alcohol withdrawal.
- Hallucinations and delusions: consider antipsychotics if these symptoms cause distress, anxiety or agitation.
- Somnolence, apathy and psychomotor slowing: reduce sedatives, start mobilization, physical therapy, create a stimulating environment (family visits, music, therapeutic activities).
STEP 4: MONITOR the patient's cognition and the effect of treatments
Assess frequently, using validated scales (RASS, NRS, CAM-ICU, etc), according to local guidelines.
Are the symptoms resolving with treatment of underlying causes?
YES
NO
- Reduce symptomatic drug treatment to lowest effective dose
- Continue preventive non-pharmacologic measures (Reference Card A)
- Re-assess underlying causes / triggers daily
- Consider follow-up for long-term cognitive disorders
STEP 5: Search for LESS COMMON underlying causes
Acute encephalopathy / delirium may persist despite optimal treatment of the underlying cause. If none of the common underlying causes is present, or delirium persists or worsens under treatment, consider less common underlying causes. These are shown in Reference Card E.

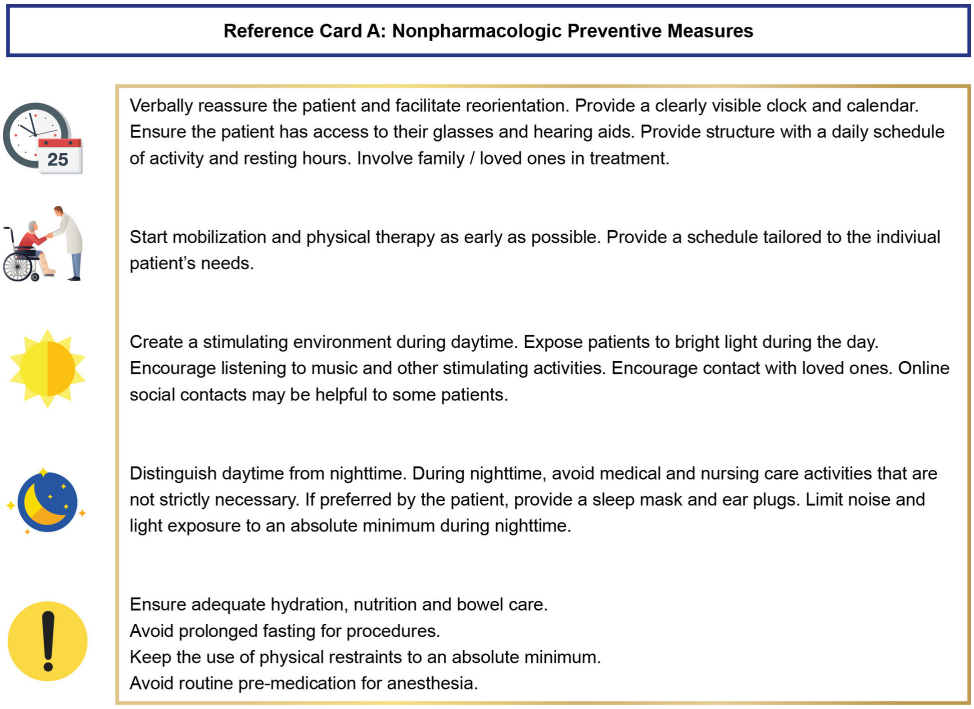


Figure 1b.

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SUPPLEMENTARY MATERIALS

Additional File 1: List of Panel Members and Affiliations and Detailed Report of the Modified Delphi Process

Download: https://deliriumjournal.com/article/90652-the-delphi-delirium-management-algorithms-a-practical-tool- for-clinicians-the-result-of-a-modified-delphi-expert-consensus-approach/attachment/189613.pdf

Additional File 2: Full set of Algorithms and Reference Cards

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