



Postoperative delirium in older adults: a surgeon's guide and clinical practice review

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Abstract: Postoperative delirium (POD) is an acute change in mental status following surgery or a procedure. POD is the most common postoperative complication in older adult patients. As the population ages and more older adults choose to undergo operations, recognition and management of POD is becoming increasingly important to patients and to health systems. Factors that contribute to POD span many domains, including but not limited to medications, infections, immobilization, and metabolic derangements. Prevention is central to management; evidence-based strategies include adequate pain control, infection prevention, good sleep hygiene, optimization of hearing and vision, consistent re-orientation to time and place, and frequent mobilization. In patients who experience POD, interdisciplinary care focused on re-orientation, medication management, and sleep hygiene has been successful. It also is important to limit use of antipsychotic or sedative medications whenever possible—although sometimes successful in controlling dangerous behavior, these medications prolong and do not prevent delirium. POD can lead to delayed surgical healing, prolonged hospital stays, long-term cognitive dysfunction, and substantial healthcare costs. It is thus important that healthcare providers understand how to prevent, recognize, and treat POD. This review summarizes the incidence and risk factors, presentation and diagnosis, prevention, management, and broader impact of POD.

Keywords: Postoperative delirium (POD); cognitive impairment; older adults

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Introduction

Postoperative delirium (POD) is acute dysfunction of cognition and attention that occurs in older patients following major surgery. POD is associated with prolonged

hospitalization, increased risk of readmission and nursing home placement, and impaired physical functioning causing about \$185 billion per year in healthcare costs in the United States (1–4). As the population ages and more older adults undergo major surgeries (5), POD is increasingly burdening

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Table 1 Risk factors for postoperative delirium

Predisposing factors	
Age >70 years	
Malnutrition	
Limited functional status	
Baseline cognitive dysfunction	
Sensory impairment	
Substance abuse	
Depression	
Anemia	
Diabetes	
Peripheral vascular disease	
Precipitating factors	
Antihistamine	
Tricyclic antidepressant	
Benzodiazepine	
Analgesic	
Bronchodilator	
Bladder control	
Antiparkinsonian	
Infection	
Dehydration	
Trauma	
Surgery	
Emotional stress	
Sleep deprivation	
Hydroxyzine, diphenhydramine	
Amitriptyline	
Lorazepam	
Codeine	
Theophylline	
Oxybutynin	
Benzotropine	
Intraoperative factors	
Urgency of procedure	
Duration of procedure	
Hypotension	
Blood loss	
Blood transfusion	

Table 1 (continued)**Table 1** (continued)

Postoperative factors	
Electrolyte imbalance	
Blood transfusion requirement	
Hypoxemia	
Pain	
Lack of mobilization	
Sleep/wake disturbances	
Missing hearing aids or other devices required for communication	

health systems (6,7). Thus, it is imperative that surgeons understand how to prevent, recognize, and treat POD. The purpose of this review is to provide a concise synopsis of key concepts and present simple practice modifications that surgeons can implement when caring for their older patients. The content of this piece has been selected and assembled by experts in the fields of surgery, geriatrics, and geriatric surgery—it is not the product of a systematic review.

Incidence and risk factors

The incidence of POD varies widely based on the patient population, ranging up to 77% (8-11). POD occurs more frequently after orthopedic (12), cardiac (9,11), and noncardiac thoracic surgeries (9).

There are many known risk factors for POD at each stage of operative care (*Table 1*), a selection of which are discussed in this review. Age is one of the most prominent risk factors, with patients >70 years old at increased risk of POD (13). Preoperative risk factors also include malnutrition, preexisting cognitive impairment, impaired functional status, substance abuse, and anemia (7,8,14-16). Prolonged operative time (8,17), required blood transfusion (18), and type of surgery are intraoperative risk factors for POD. Postoperatively, both uncontrolled pain (19,20) and high doses of opioids (20) increase the incidence of POD, in addition to immobilization (21), electrolyte derangements (22), infections (2), anticholinergic medications (23), and benzodiazepines (24).

Presentation and diagnosis

POD can present immediately after anesthesia in the post-anesthesia care unit through hospital discharge (25). Cases

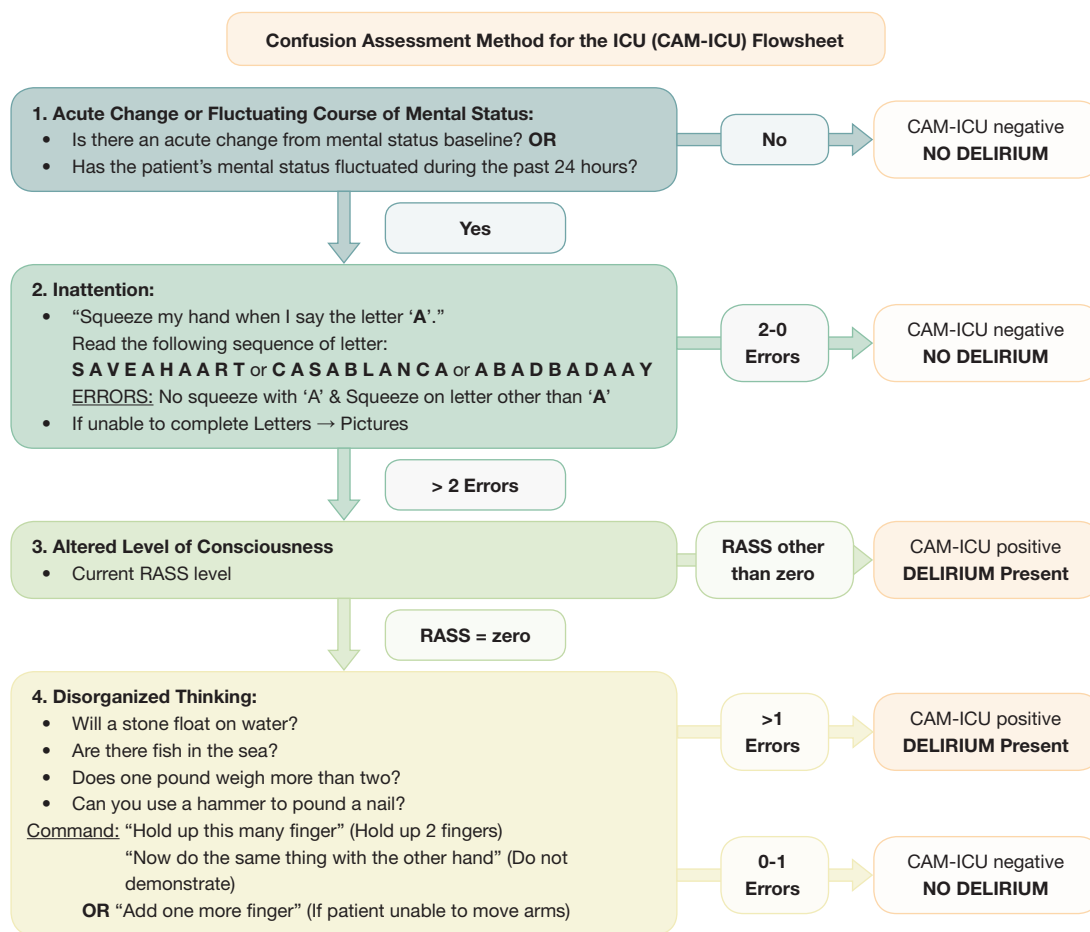


Figure 1 Confusion Assessment Method algorithm. RASS, Richmond Agitation Sedation Scale. Copyright © 2002, E. Wesley Ely, MD, MPH and Vanderbilt University, all rights reserved.

of POD vary in length and etiology. Previous studies indicate that >50% of POD cases go undocumented; false-negative rate is >80% on the day of surgery and the first day after surgery (26).

Recognized cases of POD often present as a change from a patient's baseline mental status, characterized by disorientation and fluctuations in attention. POD can be classified as one of three subtypes: hyperactive, characterized by agitation; hypoactive, characterized by lethargy; or mixed, fluctuating between hyperactivity and hypoactivity (27,28). Hypoactive delirium is most common in older patients, followed by mixed presentation, while pure hyperactive delirium is rare (29). It is important to distinguish hypoactivity, lethargy, and sluggishness associated with delirium from symptoms related to the effects of anesthesia. Other symptoms of POD can include difficulty focusing, hallucinations, slurred speech, rapid

mood swings, and restlessness (30).

The first step in assessing a patient who may be experiencing POD is to determine their level of arousal, often done using the Richmond Agitation Sedation Scale (RASS) (31). If the patient is unarousable (RASS score: -5) or in a state of deep sedation (RASS score: -4), they should be immediately assessed for ability to protect their airway and for transfer to a higher level of care. Once stabilized, a broad workup for unresponsiveness should be performed, as isolated POD itself does not cause life-threatening changes in mental status.

For arousable patients with RASS scores of -3 or higher, assessment for delirium is the next step. The 3-Minute Diagnostic Confusion Assessment Method (3D-CAM) (32-34) and Confusion Assessment Method for the Intensive Care Unit (CAM-ICU) (35) are most commonly used. These tools give a stepwise approach to assess attention, level of

consciousness, and disorganized thinking (*Figure 1*). Based on a patient's ability to perform certain tasks, they are considered delirious (CAM positive) or not delirious (CAM negative). The 3D-CAM model is used for patients who can verbally respond to questions while the CAM-ICU sequence can be used for patients who are intubated or unable to speak. These assessments are optimally performed and documented by nurses on a daily basis (35).

Prevention

Prevention is the best treatment for POD. Patients should be frequently re-oriented to time and place, the reason for their hospitalization, and the treatment they are receiving. Pain levels should be closely monitored, as uncontrolled pain is a common cause of POD (36,37). However, excess dosing of narcotic pain medications can also precipitate or exacerbate delirium (9); accordingly, it is important to use a multimodal pain regimen to spare opioid use and assess patients both before and after administration of narcotics and to adjust opioid dosing accordingly. Patients' intake and output should be tracked carefully to identify, prevent, and/or treat constipation and urinary retention (9,37). In many patients, a prophylactic bowel regimen is helpful.

Sensory aids (e.g., hearing aids, glasses, dentures) should be returned to patients immediately after surgery to facilitate communication and acclimation to their environment (9,37). Patients also should be mobilized as early as possible after surgery (38). The sleep/wake cycle should be maintained as best as possible in the hospital environment by limiting alarms, connections to lines and monitors, and collection of vital signs overnight to interventions that are absolutely necessary. In addition, lights and televisions should be turned off during the night, while window shades should be opened during the day (9,37). Engaging the patient's family in these preventive strategies is often helpful and having family or friends present at bedside can assist with orientation (38). Music therapy and pet therapy have also been shown to improve mood and patient engagement. (39,40).

Frequent and focused review of medications can limit exposure to medications that might contribute to POD. In general, it is best to avoid anticholinergics (i.e., amitriptyline, oxybutynin, scopolamine), antihistamines (i.e., diphenhydramine, hydroxyzine), and benzodiazepines (i.e., diazepam, lorazepam, alprazolam), especially in older patients (41). In addition, it is important to resume certain

home medications as soon as possible to avoid withdrawal, including in those patients with underlying dementia treated with cholinesterase inhibitors (e.g., donepezil, rivastigmine) as well as those on dopamine agonists (e.g., carbidopa-levodopa) for Parkinsonism (9,42).

Preventative measures are often best implemented with multidisciplinary care. Many care models including geriatric surgery co-management models between geriatrics and surgery teams have been successfully tested and deployed in the postoperative setting (43-45). The Geriatric Surgery Verification Program (GSVP), born out of the partnership between the American College of Surgeons and the John A. Hartford Foundation, is one such model. GSVP specifies 32 standards to optimize preoperative, intraoperative, and postoperative care of older adults (46). Early data show that patients cared for with the GSVP multidisciplinary model experience lower rates of POD (47).

Management

Perhaps the most important component of managing POD is to treat the underlying causes (9,36) optimally via comprehensive evaluation including a current history, physical examination with emphasis on neurologic assessment, appropriate laboratory testing and imaging, and review of current medications. The basic medical assessment should include a complete blood count to evaluate for anemia and infection, a metabolic panel to assess renal function, and urinalysis (9). Patients also should be evaluated for uncontrolled pain, constipation, and urinary retention (9,37). For patients without focal neurologic symptoms, computed tomography of the head is considered to be of low diagnostic value to assess POD (9). Specific consideration should be given to the potential need for reversal of anesthetic agents that may have prolonged effects.

Once potential underlying causes have been addressed, nonpharmacologic interventions should be pursued. The mainstays of POD treatment are the same elements discussed above as preventative measures, including frequent re-orientation, early return of sensory aids, early mobilization, and normalization of sleep/wake cycles.

Pharmacotherapy is reserved for agitated patients who are a physical threat to themselves or others despite behavioral interventions and nonpharmacologic treatments. These drugs do not treat or reverse POD but rather sedate patients to help control unsafe behaviors (48). When pharmacologic treatment is necessary, it is important to

evaluate for continued need on a daily basis (36).

Antipsychotics are the pharmacologic treatment of choice when required for POD. Haloperidol, a typical antipsychotic, is used by many as a first-line agent (9,37). Haloperidol can reduce the length of episodes of agitated delirium (49). It is recommended to start with a low dose (0.5–1 mg) and repeat dosing as necessary (9,37,50). Atypical antipsychotics such as risperidone, olanzapine, and quetiapine are alternatives to haloperidol and are preferred in certain cases due to lower risk of extrapyramidal side effects (41). Consensus has not been reached as to their effectiveness or superiority to haloperidol to control dangerous POD symptoms (9,37,50). Before administering antipsychotics, it is important to perform an electrocardiogram because antipsychotics can cause QTc prolongation. Thus for patients with prolonged QTc or Parkinsonism, antipsychotics are contraindicated (41). Further, benzodiazepines can exacerbate delirium and should be avoided in patients with POD unless the primary etiology of POD is benzodiazepine withdrawal (41).

Impact

The impact of POD can be felt well beyond a patient's postoperative admission. Patients who experience POD have lower cognitive function as measured by the Mini Mental State Examination one month after surgery and as long as 1 year after surgery (51). In addition, as many as one-third of patients with POD who require admission to a post-acute care facility after surgery show continued symptoms of delirium six months after their operations (52). These patients with persistent delirium have a higher rate of 1-year mortality (52) and lower rate of functional recovery than those whose POD resolved (53).

Treatment of POD requires substantial healthcare resources, with average cumulative costs of >\$40,000 per patient (6). These costs are attributable to delirium alone and not to the surgical treatment that prompted POD. This metric allows us to extrapolate to a cost of >\$32 billion per year to treat an estimated 700,000 patients with POD in the United States (6). These costs are the result of longer lengths of postoperative hospital stay, more frequent complications and readmissions, and long-term functional decline (7,54). In addition to financial costs is the impact of POD on families—patients often do not recover their baseline levels of physical or cognitive function and require substantial assistive care.

Conclusions

POD is the most common postoperative complication in older adults and can occur at any time after a patient's operation. Risk factors for developing POD include age, malnutrition, baseline cognitive dysfunction, anemia, pain, lack of mobilization, and disruption of sleep/wake cycles. POD is often diagnosed with CAM and treated with frequent patient re-orientation as well as helping patients return to their normal daily routines. Antipsychotic medications can be helpful for symptom management in patients who experience uncontrolled agitation that poses a danger to self or others but should not be used for patients without these symptoms. Ultimately, the best form of treatment is prevention, which can be accomplished through standardized behavioral interventions carried out by multidisciplinary care teams.

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