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Postoperative delirium: Why, what, and how to confront it at your institution

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Abstract

Purpose of review: This article reviews the importance of postoperative delirium, focusing on the older surgical population, and summarizes the best-practice guidelines about postoperative delirium prevention and treatment which have been published within the last several years. We also describe our local experience with implementing a perioperative delirium risk stratification and prevention pathway, and review implementation science principles which others may find useful as they move toward risk stratification and prevention in their own institutions.

Recent findings: There are few areas of consensus, backed by strong experimental data, in postoperative delirium best-practice guidelines. Most guidelines recommend preoperative cognitive screening, nonpharmacologic delirium prevention measures, and avoidance of deliriogenic medications. The field of implementation science offers strategies for closing the evidence-practice gap, which we supplement with lessons learned from our own experience implementing a perioperative delirium risk stratification and prevention pathway.

Summary: Postoperative delirium continues to be a serious perioperative complication commonly experienced by older adults. Growing appreciation of its prognostic implications and evidence behind multidisciplinary, collaborative, and focused prevention strategies rooted in implementation science have prompted several major groups to issue consensus guidelines. Adopting best practices postoperative delirium risk stratification and prevention pathways will improve perioperative care for older adults.

Keywords

Aging; Older Adults; Delirium; Implementation science; Medications

Introduction

Postoperative delirium (POD) remains a serious problem for older surgical patients. We briefly review POD and summarize the current best-practices recommendations from major governing bodies on POD management. There is consensus in 3 major areas: the need for preoperative cognitive screening, the importance of nonpharamacologic delirium prevention

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measures, and the avoidance of deliriogenic perioperative medications whenever possible. These 3 areas were made particular targets of our local delirium risk stratification and prevention pathway, which leveraged principles of implementation science to adopt best practices care for older adults at high risk of POD. We describe our experience with implementing this pathway to provide guidance for institutions interested in approaching this important clinical issue in their own patient population.

Postoperative delirium: Overview

More than one-third of all inpatient surgeries occur in patients age 65 and older(1) and this number will increase as the population ages. Postoperative delirium (POD) is one of the most common postoperative complications affecting this group,(2) occurring in 5% to 15% of older surgical patients,(3) or up to 50% of special populations like cardiac surgical patients(4). The hallmarks of delirium are inattention, disorientation, memory impairment, and impaired psychomotor activity.

Risk factors for the development of POD include older age, pre-existing cognitive dysfunction, poor baseline functional status, and visual or sensory impairment. Medical comorbidities such as diabetes, heart failure, and renal failure are also associated with increased risk. Perioperative factors that can impact the risk of POD include surgical complexity and duration, postoperative pain management, and the use of certain medications in the perioperative setting. Experts have argued that early screening and identification of patients at high risk for development of delirium is critical in order to help prevent POD.(5)

The consequences of POD are wide-ranging, and traditional adverse outcomes that are reliably associated with delirium – such as mortality, increased length of hospital stay, and increased hospital costs – have been described in detail elsewhere. Adding to these is an increased focus on patient-centered outcomes, and there is growing appreciation that, after POD, older adults suffer accelerated cognitive and functional decline compared to their peers, with more falls and increased discharge rates to skilled nursing facilities(6-8). Distress experienced by delirious patients and their families is severe, may last beyond a year, and may result in post-traumatic stress disorder.(9, 10)

While these negative emotional, physiologic, and economic outcomes are unlikely to be completely eliminated, they deserve attention because approximately half of delirium cases occurring in the hospital are thought to be preventable.(11) A variety of preventative strategies have been studied and various guidelines have been recommended by expert groups.(2, 12-14) Interventions supported by the best evidence include careful consideration of medications administered peri-operatively and provision of non-pharmacologic multicomponent interventions.(15) Information about POD, delivered preemptively whenever possible, empowers visitors to support high-risk patients and helps mitigate the negative emotional consequences.(16) Given the predicted demographic aging of the surgical patient population in the coming years, it will become increasingly important to implement multicomponent prevention and management strategies at our institutions, as well as to develop better screening tools to identify those patients at highest risk of POD.

Recommendations: Seeking consensus

There are four widely accepted best-practice guidelines for the prevention and management of postoperative delirium, published by the American Geriatrics Society (AGS),(12) American College of Surgeons (ACS),(13) American Society of Anesthesiologists (ASA),(2) the European Society of Anaesthesiology (ESA).(14) An additional set of recommendations derived from the Sixth Perioperative Quality Initiative consensus conference (POQI-6)(15) should also be used to guide perioperative delirium initiatives. Most guidelines make recommendations for the pre-operative, intra-operative and postoperative management of older patients at risk for POD (Table 1). The POQI-6 guidelines go somewhat further, recommending – based on evidence judged to be strong – that hospitals and health systems develop multidisciplinary processes to address POD, including risk stratification and postoperative delirium screening.

There are some areas of consensus. All recommend pre-operative screening for pre-existing neurocognitive dysfunction given that it is a known risk factor for developing POD. Additionally, all guidelines emphasize the use of non-pharmacologic interventions to help minimize the risk of postoperative delirium in the at-risk older adults. These non-pharmacologic interventions include reorientation, rapid return of eyeglasses and hearing aids, improved sleep hygiene, and delirium education for health professionals.(2, 12-14)

There remain important areas of uncertainty. Many, but not all, guidelines recommend monitoring the depth of anesthesia with the use of processed EEG monitoring in order to avoid burst suppression.(2, 12, 14) The European Guidelines and ASA Brain Health Initiative Guidelines both advocate for the maintenance of hemodynamics and cerebral perfusion during general anesthesia, while the others do not comment on this(2, 14) or conclude evidence is insufficient(15), particularly in light of the recently published ENGAGES trial.(17) The ASA, AGS, and ACS/NSQIP guidelines all recommend consideration of regional anesthesia for analgesia, or as a supplement to general anesthesia, in order to minimize the use of deliriogenic opioids. However, most of the guidelines state that there is insufficient evidence to support the use of regional anesthesia over general anesthesia to reduce the risk of POD.(2, 12-14)

Overall, there are few interventions that are guided by high-quality evidence and the majority of these guidelines are based on expert consensus. The lack of high-quality evidence makes it challenging to select and implement targeted clinical interventions in the perioperative area, despite strong recommendations to do so.(15)

Medication use: An area of agreement

Despite the paucity of high-quality evidence supporting certain intraoperative interventions, there is stronger evidence regarding avoiding the use of specific medications in patients at risk for POD. The “American Geriatrics Society 2019 Updated AGS Beers Criteria for Potentially Inappropriate Medication Use in Older Adults” provides a list of potentially inappropriate medications (PIMs) and offers recommendations regarding the use of these medications in high-risk populations (Table 2).(18) Although the 2019 Beers Criteria lists

over 40 medication classes, there are certain medications that are more commonly used by anesthetists in the perioperative area. These medications include benzodiazepines, anticholinergics, antipsychotics, meperidine and gabapentin.

The 2019 Beers Criteria strongly recommends against the use of benzodiazepines in patients greater than 65 years old due to the potential for POD, cognitive impairment and increased falls. The guideline also strongly recommends that medications with anticholinergic properties, such as diphenhydramine, promethazine, and scopolamine, should be avoided in high-risk patients. Antipsychotics should be avoided except for the use as a short-term antiemetic or for treatment of psychiatric disease not responsive to behavioral interventions. Additionally, avoidance of meperidine in favor of other opioids is strongly recommended, as meperidine increases the risk of neurotoxicity and POD. Gabapentin may cause oversedation in patients with reduced renal function and should not be co-administered with opioids. Notably, in the updated 2019 guidelines, the avoidance of H2-receptor antagonists changed from a moderate strength recommendation to a low strength recommendation. Since many of these PIMs have strong evidence associating them with an increased risk of POD, these recommendations serve as a potentially critical point of intervention for anesthesiologists during the perioperative management of high-risk patients.(15, 18)

Guiding principles for approaching POD in clinical practice

Addressing a problem such as POD does not end with identifying an effective intervention; successfully integrating such changes presents a formidable challenge. Recognition of this difficulty has led to the study of Implementation Science, a field which focuses on design and evaluation of strategies to promote adoption of behavior change leading to uptake of evidence-based interventions.(19) One proposed approach for addressing a problem involves dividing it into three phases: pre-implementation planning, designing the implementation strategy, and evaluating the implementation strategy.(20)

A critical aspect of pre-implementation planning is identifying the evidence-practice gap (i.e., the difference between what the evidence suggests we should be doing and what we are actually doing, and how health outcomes would change if behavior changed), as making the case for organizational change is stronger when tangible, achievable benefit can be demonstrated. Similarly, demonstrating why a change should be a priority for an organization can be important for driving adoption.(21) Another aspect of this phase is identifying and reaching out to stakeholder communities to evaluate individual interests and readiness to accept change.

While designing an implementation strategy in the second phase, specific changes in behavior for all parties need to be clearly defined. At the same time, barriers to these changes should be identified so that evidence-based strategies for behavior change can be integrated into the process. Commonly used theories and frameworks (e.g., the COM-B model) should form the basis for behavior change strategies.

Lastly, designing methods to evaluate the implementation strategy is necessary for accountability. Evaluation should focus on not only key metrics for the desired outcome, but

also whether chosen strategies for modifying behavior were successful or not. Additional frameworks are available to aid selection of appropriate process and outcome measures. This information should then be used to make iterative updates to the process.

The principles described above are important precursors to the design and implementation of perioperative best practices for those at high risk of delirium. In addition, factors related to both the organization and individuals within the organization or perioperative department must be taken into account.

One of the first steps to designing a successful perioperative delirium intervention involves engaging stakeholders in perioperative care, including nurses, anesthetists, surgeons, patients and families, organizational and/or departmental leadership, pharmacists, and other providers of postoperative medical and ancillary care. All of these individuals influence patient care: for example, anesthesiologists administer medications and write perioperative orders; surgeons direct postoperative care; nurses provide direct patient care, education, and non-pharmacologic interventions; leadership determines organizational or departmental priorities; and family members may spend a significant amount of time with their loved ones – potentially serving an essential front-line role in identifying and/or managing POD. Integrating input from stakeholders into the behavior change intervention is crucial at all phases of the project.

A method for stratifying a patient's risk for POD is a practical item which must be in place for a preventative intervention to be successful. Several such predictive tools have been published, such as the DEAR instrument,(22) the Delphi score(23), and the Age, World backward, Orientation, iLlness severity, and Surgery-specific risk (AWOL-S) score. (24) Communication of the patient's calculated POD risk to all stakeholders allows them to focus their attention and efforts. This communication can take many different forms, including, but not limited to, a flag in the electronic medical record (EMR), explicitly creating a new step in all provider handoffs, and providing written and video materials to families of high-risk patients.

Next, stakeholders need to know what to do with this information and how to ensure care continues throughout the patient's hospital stay. For example, recommendations on medications to preferentially use or to avoid, non-pharmacologic interventions that can be used in multiple locations (e.g., surgical recovery, hospital ward, or the ICU), and special consideration for involvement of ancillary resources like physical therapy and case management to improve care should be widely available. These recommendations can be communicated through education sessions, distribution of physical educational material, EMR enhancements, and ordersets, among others.

Finally, evaluation of the effectiveness of interventions is necessary to determine whether the intervention should be continued or new strategies should be adopted. This may take the form of measuring the compliance with recommended interventions for high-risk patients, as well as tracking the subsequent incidence of POD with validated screening tools. This ongoing process review is a core tenet of quality improvement that should not be ignored.

Implementing core POD principles in routine clinical practice: Our experience

We used the principles above to implement a perioperative delirium prevention and treatment pathway at our institution. This intervention was inspired by an observed evidence-practice gap related to awareness and use of evidence-based best practices for perioperative delirium. Perioperative interventions were designed in collaboration with a healthcare system-wide campaign to address delirium, highlighting the importance of organizational level support in coordinating delirium prevention and treatment efforts across units.

In the pre-implementation phase, we identified multiple stakeholders to target with this information: nurses in pre-operative and recovery units, anesthesia providers, surgeons, and perioperative and quality improvement leadership. We obtained buy-in and feedback from stakeholder groups and used that information iteratively to modify our intervention. Educational information and recommendations were presented at meetings (e.g., staff meetings, Grand Rounds), via email, and by posting educational materials. For example, to make this information easily available to anesthesia providers in the operating room, we attached cognitive aids to the anesthesia computer and cart, placed posters in common spaces, and posted reference tools on the departmental website. We also made modifications to the standard post-anesthesia care unit (PACU) orderset to eliminate deliriogenic medications in favor of alternative medications, and to introduce a multicomponent nursing bundle to PACU care. Nurses underwent intensive training on performing and recording delirium risk stratification prior to surgery.

The implementation phase included introduction of delirium risk stratification in the pre-operative area,(24) modifications to the EMR to communicate high delirium risk to providers, focus on avoidance of Beers Criteria medications and best practice patient safety measures perioperatively, provider-to-provider communication, and non-pharmacologic delirium prevention measures in the recovery room. We particularly noted that the EMR is a powerful tool to help motivate behavior change. Addition of subtle EMR reminders corresponded with a near doubling of anesthesia provider compliance with our intervention within a few weeks. Reminders sent by more obtrusive methods, such as departmental wide pages after first-case start, served only to frustrate our colleagues without any noticeable subsequent change in behavior.

We integrated these changes into existing workflows whenever possible (e.g., introducing minimal screening questions into the existing pre-operative workflow used by nurses) in order to overcome anticipated barriers to modifying behavior. We also coordinated our efforts with institution-supported incentive programs for quality improvement measures for resident physicians and nurse anesthetists, which facilitated awareness and behavior uptake throughout our department.

We evaluated the impact of our intervention on outcomes retrospectively, as well as process metrics related to behavior modification prospectively. Selection and tracking of process metrics at the time of intervention design allowed us to track effectiveness of behavior

modification and to provide feedback on compliance with the intervention to providers in our department in real-time. This allowed us to intermittently adjust our approach and to reinforce changes or to motivate future behavior.

Conclusions

POD is a significant source of patient emotional distress and morbidity, as well as financial cost. Many guidelines aimed at preventing POD have been published by expert groups; however, adopting such recommendations on an organizational level may prove challenging without higher level evidence supporting the effectiveness of these interventions. Using concepts rooted in implementation science is recommended to promote uptake of evidence-based behaviors by healthcare providers, staff, and even family support members. Implementation science strategies and lessons learned from our institutional experience may prove useful for others aiming to implement similar changes.

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Key points:

- Postoperative delirium remains an important perioperative complication for older adults
- Best-practices guidelines generally agree that older adults should undergo cognitive screening, that deliriogenic medications should be avoided, and that nonpharmacologic delirium prevention measures should be used.
- Closing the evidence-to-practice gap by applying best-practices delirium prevention strategies to perioperative care should be guided by implementation science principles.

Table 1:

Beers Criteria Potentially Inappropriate Medications Commonly Used in Anesthesia*

Medication Class	Examples	Precautions	Rationale
Pain Medications	**NSAIDs** Ketorolac (*Toradol*) Diclofenac Ibuprofen	Avoid when GFR < 30 (i.e., CKD stage IV & V) or AKI, and use caution with repeated doses	Increased risk of GI bleeding and AKI (specifically for ketorolac)
	Gabapentinoids Gabapentin (*Neurontin*) Pregabalin (*Lyrica*)	Reduce dose or avoid when GFR < 60	Increased risk of over-sedation
	Meperidine (*Demerol*)	Avoid, especially in patients with CKD	Higher risk of neurotoxicity, including delirium, than other opioids
Sedative Hypnotics	**Benzodiazepines** Midazolam (*Versed*) Lorazepam (*Ativan*)	Avoid, except for specific indications such as seizure or alcohol withdrawal	Increased risk of delirium, cognitive impairment, falls, and fractures
Anticholinergics	**Tricyclic Antidepressants** Amitriptyline (*Elavil*) Nortriptyline (*Pamelor*)	Avoid	Increased risk of over-sedation, central anticholinergic side effects, delirium, and orthostatic hypotension
	Diphenhydramine (*Benadryl*) Hydroxyzine (Vistaril) Prochlorperazine (*Compazine*) Promethazine (*Phenergan*) Scopolamine	Avoid	Increased risk of over-sedation or central anticholinergic side effects, including delirium
Antipsychotics	Haloperidol (*Haldol*) Olanzapine (*Zyprexa*)	Avoid, except for in use in psychiatric disease or as short-term antiemetic	Increased risk of stroke and cognitive decline in dementia
Antidopaminergics	Haloperidol (*Haldol*) Metoclopramide (*Reglan*) Prochlorperazine (*Compazine*) Promethazine (*Phenergan*)	Avoid in patients with Parkinsonian disorders	Increased risk of extrapyramidal side effects and delirium
Steroids	Dexamethasone (*Decadron*)	Avoid or use cautiously	Increased risk of delirium

Abbreviations: NSAIDs, non-steroidal anti-inflammatory drugs; GFR, glomerular filtration rate; CKD, chronic kidney disease; AKI, acute kidney injury; GI, gastrointestinal; ESRD, end-stage renal disease

*Adapted from *AGS 2019 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults* [18]

Table 2.

Summary of consensus recommendations for postoperative delirium.

	Year Published	Multi-component Intervention	Pre-operative Cognitive Screen	Depth of Anesthesia Monitoring	Regional Anesthesia	Maintenance of Cerebral Perfusion	Fluid Management	Medication management
AGS [12]	2015	Recommended	Recommended	Recommended	Consider	N/A	N/A	Avoid Beers medications
ACS/NSQIP [13]	2016	Recommended	Recommended	N/A	Consider	N/A	Goal-directed	Avoid Beers medications
ESA [14]	2017	Recommended	Recommended	Recommended	N/A	Recommended	N/A	Judicious BZ use
ASA Brain Health [2]	2018	N/A	Recommended	Recommended	Unable to recommend	Recommended	N/A	N/A
POQI-6 [15]	2020	Recommended	Recommended	Unable to recommend	Unable to recommend	N/A	N/A	Avoid Beers medications

Abbreviation: AGS, American Geriatrics Society. ACS/NSQIP, American College of Surgeons / National Surgical Quality Improvement Program. ESA, European Society of Anaesthesiology. BZ, benzodiazepine. ASA, American Society of Anesthesiologists. POQI-6: Perioperative Quality Initiative – Sixth Conference.