PERIOPERATIVE DELIRIUM/AGITATION

Associated With the Use of Anesthetics and/or Adjunct Agents: A Study of Patient Behaviors, Injuries, and Interventions to Mitigate Risk

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Anesthetics and adjunct agents have a long history of being associated with patients engaging in delirious or agitated behavior in a perioperative setting. Prior to this study, few have explored the topic with a focus on safety for both the patient and staff. We explored the Pennsylvania Patient Safety Reporting System (PA-PSRS) database for event reports to identify bouts of delirium/agitation associated with anesthetics and/or adjunct agents that occurred during the pre-, intra-, or postoperative period. We identified 97 event reports from 63 healthcare facilities over a two-year period. Patients' ages ranged from 1 to 91 years and 66% of the patients were reported as male. Also, 8% of the delirium/agitation occurred preoperatively, 8% intraoperatively, and 84% postoperatively. Across all three operative periods, 62% of the reports described dangerous/nonviolent behavior and 26% described dangerous/violent behavior. Additionally, 40% of the event reports described one or more patient injuries (e.g., cardiopulmonary arrest, asphyxiation, hematoma, prolapse/dehiscence, progressive ischemia) and 36% of the patients required additional healthcare services or monitoring (e.g., intra- or interfacility transfer, additional surgical procedure). Finally, 54% of the event reports described patient behavior that created an immediate and high risk of staff harm. Overall, the current study provides novel insight into how delirium/agitation has varying safety implications depending on the operative period. We encourage readers to review **Table 5**, which proposes a four-phase intervention package to prevent, treat, and de-escalate bouts of delirium/agitation.

Keywords: *general anesthesia, monitored anesthesia care, MAC, strategies, solutions, emergence delirium, emergence agitation, preoperative, intraoperative, postoperative, occupational safety*

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Introduction

Anesthetics and adjunct agents have a long history of being associated with patients engaging in delirious or agitated behavior in a perioperative setting (e.g., stage 2 of anesthesia).[1] In a majority of literature, the condition is referred to as emergence delirium, agitation, or excitation.[2,3] The condition often begins with awakening or emergence from the anesthetic and/or adjunct agent and is followed by a return to baseline behavior after a short time period (typically less than 30 minutes).[2-6] During the bout of delirium/agitation, the patient may engage in a wide range of behavior that includes one or more of the following: violence (e.g., punching, kicking, hitting, biting), thrashing movement, aggression, combativeness, screaming, disconnect with current time and place (e.g., flashbacks, hallucinating, disoriented), attempting to exit bed/table, and attempting to remove medical apparatuses.[2,4-6]

Previous literature acknowledged the risk of harm caused by perioperative delirium/agitation associated with anesthetics and/or adjunct agents;[2,5] however, few have studied the topic with a focus on safety for both the patient and staff. In our study, we explored the Pennsylvania Patient Safety Reporting System (PA-PSRS)[a] database for event reports to identify bouts of delirium/agitation associated with anesthetics and/or adjunct agents that occurred during the pre-, intra-, or postoperative period. Our goal is to better understand patient behavior, patient injury, interventions used to treat and de-escalate delirium/agitation, additional healthcare services or monitoring required post delirium/agitation, and risk of staff harm. Overall, we believe that the information will help both staff and patients better understand the safety implications of perioperative delirium/agitation associated with anesthetics and/or adjunct agents and potential strategies for mitigating risk of harm.

[a] PA-PSRS is a secure, web-based system through which Pennsylvania hospitals, ambulatory surgical facilities, abortion facilities, and birthing centers submit reports of patient safety–related incidents and serious events in accordance with mandatory reporting laws outlined in the Medical Care Availability and Reduction of Error (MCARE) Act (Act 13 of 2002). All reports submitted through PA-PSRS are confidential and no information about individual facilities or providers is made public.

Methods

Data Source and Sample

Data in this study were collected from event reports written by staff working in licensed healthcare facilities and submitted to the acute care PA-PSRS database. Each event report consisted of responses to many structured fields (e.g., event date, patient age, patient gender, care area) and several free-text narrative fields, which are used to describe the event. Given the unstructured nature of free-text narrative fields, the quantity and quality of the information varies from one report to another. The responses within the free-text fields of some reports are often concise and none of the reports include access to patients' medical records or other sources of information.

We conducted a two-phase process to select and identify relevant events for inclusion in the study. The first phase consisted of a database query, where we applied the following inclusion criteria:

- Event dates included: January 1, 2019, to December 31, 2020
- One or more of the following phrases were included in the free-text narrative fields: "emergence," "delir," "agitat," "thrash," "violen," "disorient," "punch," "kick," "restrain," "combat," and "ptsd."
- Care area types included**:** ambulatory surgery preoperation & discharge, ambulatory surgery, anesthesia, operating room (OR), post-anesthesia care unit (PACU)

Our query produced an output of 424 events, which were subsequently reviewed by one researcher, and the following criteria were applied to identify reports consistent with the study scope.

- Event occurred during a perioperative period, which includes the pre-, intra-, and postoperative periods.[7]
- While under an anesthetic and/or adjunct agent, including the period of emergence, the patient engaged in behavior commonly described as delirium or agitation (see introduction for a list of behaviors identified by previous literature).

Based on the criteria, we identified 97 event reports for inclusion in our study. See **Table 1** for three examples of events.

Variables Coded

We explored two sets of variables. The first set was coded by the event reporter (i.e., facility-assigned personnel who submitted the event report to PA-PSRS) and consisted of demographic and clinical variables (e.g., patient age and sex, event date, care area). The second set of variables was coded by one researcher, based on manual review of the event reports. The variables coded included operative period, patient behavior, patient injury, interventions to treat and de-escalate delirium/agitation, additional healthcare services or monitoring required post delirium/agitation, and risk of staff harm.

Descriptive Data Analysis

The variables were measured by frequency and were assessed using a descriptive analysis. A descriptive analysis is an approach where phenomena are identified and patterns are explored to better comprehend and explain the conditions in which the phenomena occur.[8,9] This type of analysis is not used to identify causal relations, rather it is used to characterize the context of the phenomena, point toward possible causal mechanisms, and generate hypotheses. With a descriptive analysis, data are presented in a manner favoring simplicity to help a broader audience readily comprehend the findings.

Results

Patient Sex and Age

Across our sample of 97 event reports, patient age was an average of 46.6 years and a median of 47 years (range of 1 to 91 years, 30 years was the 25th percentile and 67 years was the 75th percentile). Also, among 15% (15 of 97) of the reports the patients were aged 1–12 years. Finally, 66% (64 of 97) of the patients were reported as male and 34% (33 of 97) as female.

Healthcare Facilities With Event Reports

A total of 63 individually licensed healthcare facilities submitted at least one event report that described a bout of delirium/agitation associated with an anesthetic and/or adjunct agent. Among the 63 facilities, they submitted a mean of 1.5 event reports and a maximum of 5 reports, and 32% (20 of 63) submitted 2 or more event reports. Across the 63 facilities, 45 were hospitals and 18 were ambulatory surgical facilities.[b]

Operative Period of Delirium/Agitation

Across the 97 reports of delirium/agitation associated with an anesthetic and/or adjunct agent, 8% (8 of 97) occurred preoperatively, 8% (8 of 97) were intraoperative, and 84% (81 of 97) were postoperative, as shown in **Figure 1**.[c]

Patient Behavior During the Bout of Delirium/Agitation by Operative Period

Across the 97 event reports, we identified 48 unique patient behaviors described as occurring during the bout of delirium/agitation. The most frequent behaviors were: combative (n=36); agitated (n=31); disrupted, removed, or attempted to remove apparatus[d] (n=21); exited or attempted to exit bed/table (n=15); kicked (n=14); and thrashed (n=13).

We further analyzed the 48 unique patient behaviors described in the event reports by sorting them into eight different behavior themes. The themes were developed post hoc and were guided by the array of behavior described in the event reports. **Table 2** presents the frequency and percentage of event reports per operative period that included at least one behavior corresponding with each of the themes. Readers should note that each event report contributed only one count per behavior theme and the themes were not mutually exclusive (e.g., a report may have described behavior that corresponded with more than one theme).

Table 2 shows that across all operative periods, the behavior themes with the greatest percentage of occurrence were: potentially dangerous and/or verbally aggressive, dangerous/nonviolent, and

[b] The Health Care Facilities Act of Jul. 19, 1979, P.L. 130, No. 48 defines ambulatory surgical facility as "a facility or portion thereof not located upon the premises of a hospital which provides specialty or multispecialty outpatient surgical treatment. Ambulatory surgical facility does not include individual or group practice offices of private physicians or dentists, unless such offices have a distinct part used solely for outpatient surgical treatment on a regular and organized basis. For the purposes of this provision, outpatient surgical treatment means surgical treatment to patients who do not require hospitalization, but who require constant medical supervision following the surgical procedure performed."

[c] We defined the preoperative period as an event that occurred prior to incision or insertion of instrument, intraoperative as an event while the surgery/procedure was active (e.g., incision is open, instrument is inserted), and postoperative period as an event after the surgical site was closed and instrument was removed.

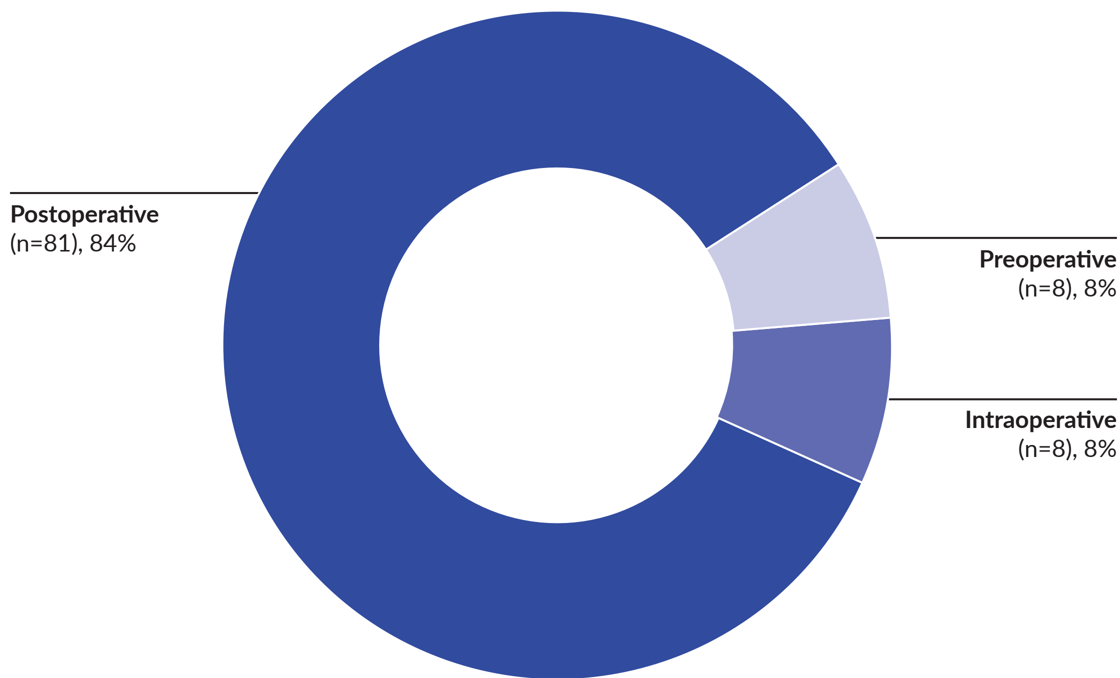
[d] Apparatuses include intravenous line, catheter, oxygen, and nasogastric tube.

Table 1. Examples of PA-PSRS Reports Reflecting Perioperative Delirium/Agitation Associated With Anesthetics and/or Adjunct Agents

Preoperative	35-year-old patient was taken to the procedure room for an esophagogastroduodenoscopy (EGD; endoscopy of upper gastrointestinal tract). **Immediately following administration of propofol, patient became extremely agitated and thrashed on the stretcher.** The physician then canceled the procedure and recommended the patient have the procedure completed at a hospital and under general anesthesia.
Intraoperative	Patient 41 years of age woke from anesthesia prior to completion of a cystoscopy procedure (endoscopy of urinary tract). The **patient began thrashing and kicked a staff member in the face.** The patient was re-sedated and the surgeon completed the procedure.
Postoperative (emergence delirium/agitation)	62-year-old patient underwent a successful cardiovascular procedure. Upon emergence in the post anesthesia care unit, **the patient was angry, combative, swung, and kicked.** The patient disrupted the surgical site and began bleeding. The patient was emergently returned to the operating room for repair and later transferred to the intensive care unit. **The patient's arm showed progressive ischemia and was ultimately amputated.** After an extended stay in the hospital, the patient was discharged to a rehabilitation facility.

Note: Information in each example was modified to ensure confidentiality.

Figure 1. Percentage of 97 PA-PSRS Event Reports That Described Delirium/Agitation Associated With an Anesthetic and/or Adjunct Agent by Perioperative Period



Note: The categories are mutually exclusive, as none of the event reports described a bout of delirium/agitation during two or more operative periods.

dangerous/violent. The table also reveals that the themes were proportionally more or less prevalent depending on the operative period. For example, in the preoperative period 100% (8 of 8) of the event reports described behavior corresponding with the potentially dangerous and/or verbally aggressive theme; however, only 68% (55 of 81) of the events from the postoperative period described the same behavior theme. In contrast, 65% (53 of 81) of the event reports from the postoperative period described behavior corresponding with the dangerous/nonviolent theme, but only 13% (1 of 8) of the events from the preoperative period described a dangerous/nonviolent theme. Across each of the three operative periods, the event reports described a relatively similar percentage of dangerous/violent theme (13%–27%). Overall, **Table 2** highlights similarities and differences in the distribution of behavior themes across the operative periods.

Most frequent behaviors associated with perioperative delirium/agitation:

1. Combative
2. Agitated
3. *Disrupted, removed, or attempted to remove apparatus
4. Exited or attempted to exit bed/table
5. Kicked
6. Thrashed

*Apparatuses include intravenous line, catheter, oxygen, and nasogastric tube

Table 2. Frequency and Percentage of Behavior Themes That Occurred During the Bout of Delirium/Agitation by Operative Period, Across 97 PA-PSRS Event Reports

Behavior Themes and Corresponding Unique Behaviors (Behavior Themes Are Not Mutually Exclusive)	Operative Periods Are Mutually Exclusive			Total, N=97 reports
	Preoperative, n=8 reports	Intraoperative, n=8 reports	Postoperative, n=81 reports	
Potentially dangerous and/or verbally aggressive (combative, agitated, aggressive, angry, belligerent, threatened, disinhibited, inappropriate, out of control, unruly, verbally abusive, wild)	8 of 8 reports (100%)	7 of 8 reports (88%)	55 of 81 reports (68%)	**70 of 97 reports (72%)**
Dangerous/nonviolent (*disrupted, removed, or attempted to remove apparatus; *exited or attempted to exit bed/table; thrashed; fell; *disrupted surgical site; flailed; sat up; rolled; flipped; *resisted staff restraint; stood on stretcher)	1 of 8 reports (13%)	6 of 8 reports (75%)	53 of 81 reports (65%)	**60 of 97 reports (62%)**
Dangerous/violent (kicked, self-harm, punched, bit, hit, swung, violent, fought, scratched)	1 of 8 reports (13%)	2 of 8 reports (25%)	22 of 81 reports (27%)	**25 of 97 reports (26%)**
Disoriented (disoriented, confused, delirious, hallucinated)	-	2 of 8 reports (25%)	14 of 81 reports (17%)	**16 of 97 reports (16%)**
Restless and/or anxious (restless, anxious)	2 of 8 reports (25%)	1 of 8 reports (13%)	12 of 81 reports (15%)	**15 of 97 reports (15%)**
Unintelligible vocalization (cried, screamed, yelled, incoherent, inconsolable)	2 of 8 reports (25%)	-	9 of 81 reports (11%)	**11 of 97 reports (11%)**
Noncompliant (uncooperative, *did not follow instructions)	1 of 8 reports (13%)	1 of 8 reports (13%)	6 of 81 reports (7%)	**8 of 97 reports (8%)**
Other behavior/reactions (*clenched teeth or fists, eyes rolled back, nonverbal)	-	1 of 8 reports (13%)	5 of 81 reports (6%)	**6 of 97 reports (6%)**

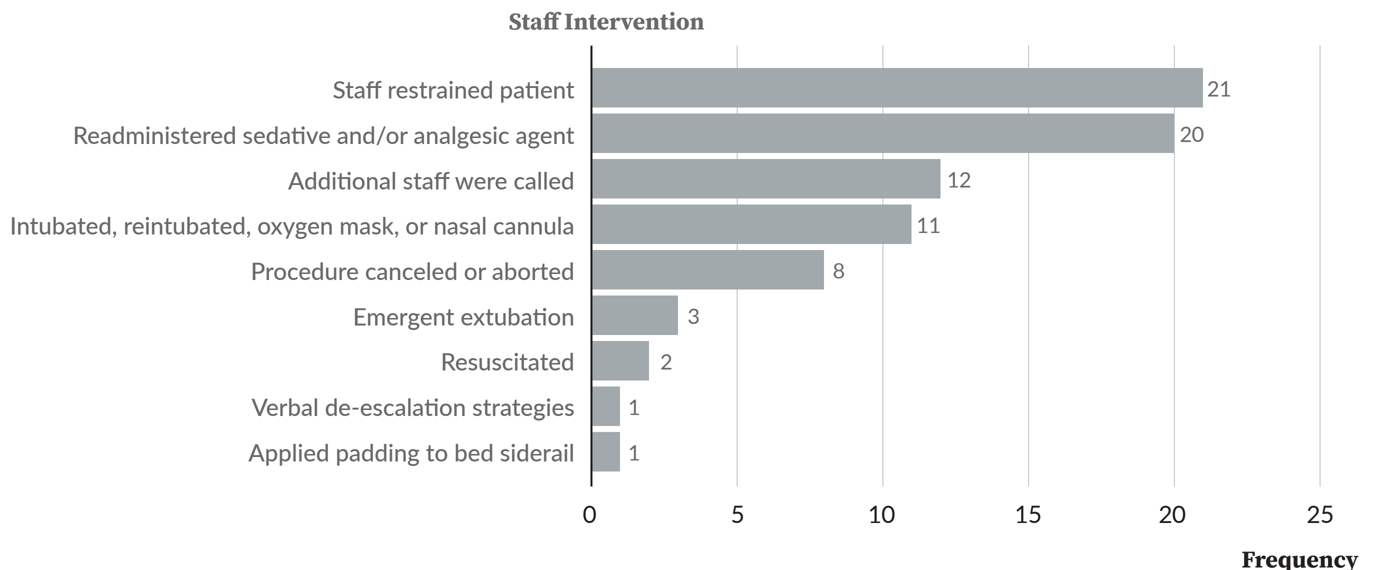
Note: The 48 unique behaviors identified from the event reports were sorted per theme and shown parenthetically in the left column. The parenthetical behaviors are listed from most to least frequent, across the 97 event reports. All behaviors were verbatim from the reports, except for those with an *. The "*disrupted, removed or attempted to remove apparatus" behavior included intravenous line, catheter, oxygen, and nasogastric tube. The header for each column identifies the number of event reports per operative period, which was the denominator used to calculate the percentages. The categories of operative period are mutually exclusive, as none of the event reports described a bout of delirium/agitation during two or more operative periods. Each event report contributed only one count per behavior theme and the themes were not mutually exclusive, as each report may have described multiple behavior themes. For example, a report may have described behavior corresponding with both the dangerous/violent theme and noncompliant theme. Cells with a – represent a zero per combination of categories.

Table 3. Frequency and Percentage of Injuries Related to Delirium/Agitation by Operative Period, Across 97 PA-PSRS Event Reports

Types of Injury (Types of Injury Are Not Mutually Exclusive)	Operative Periods Are Mutually Exclusive			Total, N=97 reports
	Preoperative, n=8 reports	Intraoperative, n=8 reports	Postoperative, n=81 reports	
Skin integrity (abrasion, bruise, laceration, and skin tear)	1 of 8 reports (13%)	2 of 8 reports (25%)	24 of 81 reports (30%)	27 of 97 reports (28%)
Intravenous (IV) infiltration	-	-	5 of 81 reports (6%)	5 of 97 reports (5%)
Cardiopulmonary arrest	-	-	2 of 81 reports (2%)	2 of 97 reports (2%)
Tooth loss	-	-	2 of 81 reports (2%)	2 of 97 reports (2%)
Asphyxiation	-	-	1 of 81 reports (1%)	1 of 97 reports (1%)
Hematoma	-	-	1 of 81 reports (1%)	1 of 97 reports (1%)
Prolapse/dehiscence		1 of 8 reports (13%)	-	1 of 97 reports (1%)
Progressive ischemia	-		1 of 81 reports (1%)	1 of 97 reports (1%)

Note: The header above each column identifies the number of event reports per operative period, which was the denominator used to calculate the percentages. The categories of operative period are mutually exclusive, as none of the event reports described a bout of delirium/agitation during two or more operative periods. Each event report contributed only one count per type of injury and the injury types were not mutually exclusive, as one event report described two types of injuries. Cells with a – represent a zero per combination of categories.

Figure 2. Frequency of Staff-Implemented Interventions During Patient's Bout of Delirium/Agitation, Across 97 PA-PSRS Event Reports



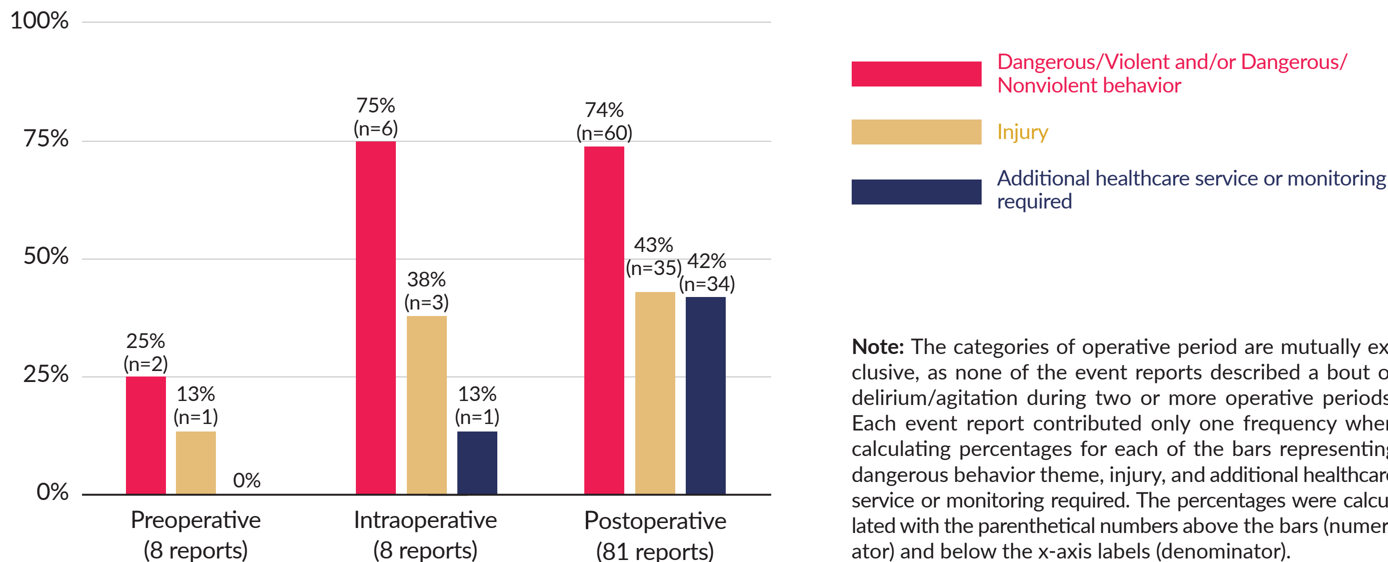
Note: The categories of interventions were not mutually exclusive, as numerous reports described staff implementing two or more interventions. Staff restraint of patient included manual and/or mechanical methods, as a response to the patients' delirium/agitation.

Table 4. Frequency and Percentage of Additional Healthcare Services or Monitoring Required Post Delirium/Agitation by Operative Period, Across 97 PA-PSRS Event Reports

Types of Additional Healthcare Service or Monitoring Required (Types of Service or Monitoring Are Not Mutually Exclusive)	Operative Periods Are Mutually Exclusive: Preoperative, n=8 reports	Intraoperative, n=8 reports	Postoperative, n=81 reports	Total, N=97 reports
Skin treatment	-	-	14 of 81 reports (17%)	14 of 97 reports (14%)
Intrafacility transfer to higher acuity unit	-	-	11 of 81 reports (14%)	11 of 97 reports (11%)
Interfacility transfer	-	-	7 of 81 reports (9%)	7 of 97 reports (7%)
Additional surgical procedure	-	1 of 8 reports (13%)	2 of 81 reports (2%)	3 of 97 reports (3%)
X-ray or CT scan	-	-	3 of 81 reports (4%)	3 of 97 reports (3%)

Note: The header above each column identifies the number of event reports per operative period, which was the denominator used to calculate the percentages. The categories of operative period are mutually exclusive, as none of the event reports described a bout of delirium/agitation during two or more operative periods. Each event report contributed only one count per type of additional healthcare service or monitoring and the types of additional services or monitoring were not mutually exclusive, as three event reports described two additional services or monitoring. Cells with a – represent a zero per combination of categories

Figure 3. Events by Operative Period That Included Dangerous Behavior, Injury, and/or Additional Healthcare Service or Monitoring Required, Across 97 PA-PSRS Reports



Note: The categories of operative period are mutually exclusive, as none of the event reports described a bout of delirium/agitation during two or more operative periods. Each event report contributed only one frequency when calculating percentages for each of the bars representing dangerous behavior theme, injury, and additional healthcare service or monitoring required. The percentages were calculated with the parenthetical numbers above the bars (numerator) and below the x-axis labels (denominator).

Patient Injury Related to the Delirium/Agitation by Operative Period

We found that 40% (39 of 97) of the event reports described one or more patient injuries (note: 38 of the event reports described 1 injury and 1 report described 2 injuries, for a total of 40 injuries). **Table 3** presents the distribution of injuries by type, which reveals that 28% (27 of 97) of event reports were related to skin integrity, 5% (5 of 97) were intravenous (IV) infiltration, 2% (2 of 97) were cardiopulmonary arrest, and 2% (2 of 97) were tooth loss.

Table 3 also shows that 1 injury occurred during the preoperative period, 3 during the intraoperative period, and 36 during postoperative. The table also reveals that the more severe injuries occurred in the intraoperative and postoperative periods (e.g. cardiopulmonary arrest, tooth loss, prolapse/dehiscence, and progressive ischemia), as opposed to preoperative.

Intervention During the Bout of Delirium/Agitation

Across all 97 event reports, 53% (51 of 97) described staff implementing one or more interventions during the patient's bout of delirium/agitation. **Figure 2** shows the frequency by type of intervention, which reveals that staff restraint of patient (manual and/or mechanical) and readministration of an anesthetic and/or adjunct agent were most frequent. Among the 8 events that involved a canceled or aborted procedure, 88% (7 of 8) were preoperative and 13% (1 of 8) were intraoperative.

Additional Healthcare Services or Monitoring Required Post-Delirium/Agitation by Operative Period

Across all 97 event reports, 36% (35 of 97) of the patients required additional healthcare services or monitoring post delirium/agitation. **Table 4** reveals that five different types of healthcare services were administered and the most frequent were skin treatment, intrafacility transfer to higher acuity unit, and interfacility transfer. Among the 7 event reports that described an interfacility transfer, 86% (6 of 7) were from an ambulatory surgical facility. **Table 4** also shows that 3% (1 of 38) and 97% (37 of 38) of the additional healthcare services or monitoring were a result of delirium/agitation during the intraoperative period and postoperative period, respectively.

Relationship Between Operative Period, Dangerous Behavior, Injury, and Additional Healthcare Service and Monitoring Required

Based on results presented in the previous sections, we developed **Figure 3** to summarize and highlight the relationship between operative period, dangerous behavior (**Table 2**), injury (**Table 3**), and additional healthcare service and monitoring required (**Table 4**). **Figure 3** shows the percentage of event reports per operative period that described behavior corresponding with the dangerous behavior themes (i.e., dangerous/violent and/or dangerous/nonviolent behavior themes). We encourage readers to note that a much smaller percentage (25%) of the preoperative events had behavior corresponding with the dangerous behavior themes than the events from the intra- and postoperative periods (75% and 74%, respectively). Additionally, **Figure 3** shows that more injuries occurred during the events in the intra- and postoperative periods (38% and 43%, respectively) than the preoperative period (13%). Based on these findings, we hypothesized that there was a relationship between the occurrence of patients' dangerous behavior themes and subsequent injuries, when collapsed across operative periods. With a two-tailed Fisher's exact test, we found a significant relation between those two variables, $p=0.0429$. A patient injury was the result of 47% of dangerous behavior events but only 24% of nondangerous behavior events.

Figure 3 also shows a difference in the percentage of additional healthcare services or monitoring per operative period. When collapsed across operative periods, we hypothesized that there was a relationship between patient injury and additional healthcare service or monitoring required. With a two-tailed Fisher's exact test, we found a significant relation between those two variables, $p=0.0171$. An additional healthcare service or monitoring was the result of 51% of the injury events but only 26% of the no-injury events. Overall, the findings in **Figure 3** indicate that fewer preoperative events involved dangerous behavior, and this may explain the lower frequency of injuries and additional healthcare services and monitoring, when compared with the intra- and postoperative periods.

Risk of Staff Injury During Patient's Bout of Delirium/Agitation

We reviewed the patient behavior described in all event reports and found that 54% (52 of 97) mentioned at least one unique behavior that represented an immediate and high risk of staff harm.[e] Among those events, 5 explicitly stated that staff were physically impacted and possibly harmed. For example, in one of those 5 events a staff member was kicked in the face.

Discussion

Implications of Findings

In the current study, delirium/agitation associated with the use of anesthetics and/or adjunct agents primarily occurred during the postoperative period, but also occurred during the pre- and intraoperative periods. Previous studies also reported delirium/agitation as occurring during the postoperative period;[5,10,11] however, very few explored the pre- or intraoperative periods. As a result, the current study provides novel insight into how the delirium/agitation has varying safety implications depending on the operative period.

The present study revealed that delirium/agitation during an intra- or postoperative period, when compared with preoperative, were related with more severe patient behavior, injuries, and additional healthcare services or monitoring (see **Figure 3** for high-level findings). For example, during the intra- and postoperative periods the patients had dangerous behavior themes described in 75% and 74% of the event reports, respectively, compared with only 25% in the preoperative events. Also, only 13% of the preoperative events had an injury while 38% and 43% of the intra- and postoperative events had an injury, respectively. As another example, *only* within the intra- and/or postoperative periods were there occurrences of the following: surgical site disruption, loss or disruption of IV access, removal of oxygen apparatus, asphyxiation, cardiopulmonary arrest, and injuries resulting in permanent disfigurement. While these finding may suggest that there is minimal risk of harm related with a preoperative bout of delirium/agitation, readers should note that 88% of the preoperative events resulted in a procedure cancellation. Unfortunately, procedures that are

[e] Any event report that included one or more of the following patient behaviors was categorized as representing an immediate and high risk of staff harm: violent, kicked, punched, swung, hit, bit, scratched, fought, thrashed, resisted staff restraint, sat up, stood on stretcher, and exited or attempted to exit bed/table.

canceled or aborted may create significant delays in diagnosis, treatment, and/or therapy. Also, the delay could be influenced by many variables, including appointment availability with the provider and a patient's avoidance of rescheduling the procedure based on a fear of a reoccurrence of delirium/agitation.[12-15] Overall, the findings indicate that delirium/agitation may have varying types of impact on the patient as a function of the perioperative period; however, the findings as a whole indicate that delirium/agitation, regardless of operative period, may have a notable and long-term impact on patient safety and well-being.

Beyond the impact on the patient, the bout of delirium/agitation may have numerous effects on staff and the healthcare organization. For example, an instance of delirium/agitation could result in staff harm and subsequent short-term challenges, such as difficulty completing the ongoing procedure and procedures scheduled for the remainder of the day. As another example, there are also longer-term implications of a staff injury, which may include the following: staff pain and suffering, burnout, service line or department loss of productivity due to understaffing, and financial burden for both the injured staff and organization. Collectively, the potential impact of perioperative delirium/agitation on patients, staff, and the organization would justify a robust intervention package to reduce risk.

Interventions to Prevent, Treat, and De-Escalate Delirium/Agitation

The current study revealed that across 63 facilities the primary strategies to treat and de-escalate a bout of delirium/agitation were patient restraint (mechanical and/or manual; note that special training and technique are required to ensure patient and staff safety during hands-on restraint), readministration of an anesthetic and/or adjunct agent, and call for additional staff. We encourage facilities to use these three aforementioned strategies and to also consider additional strategies with the goal of implementing a reliable and comprehensive intervention package to prevent, treat, and de-escalate bouts of delirium/agitation. For example, recent literature recommended an intervention package that includes the following phases: patient evaluation with individualized plan, preoperative actions, intraoperative actions, and postoperative actions.[2,16] In **Table 5** we outlined an intervention package, based on previous literature and ongoing practices at VA Pittsburgh Healthcare System, that staff should critically review and consider implementing at their facility.

Table 5. Intervention Package to Prevent, Treat, and De-Escalate Bouts of Delirium/Agitation Associated With the Use of Anesthetics and/or Adjunct Agents

Phases	Components
Patient evaluation with individualized plan[2,16]	**Day before procedure** · Electronic medical record (EMR) review for delirium/agitation risk factors. · Risk factors[2,5,6,10,16-19] may include a history of delirium/agitation, post-traumatic stress disorder (PTSD), traumatic event (e.g., individual that experienced sexual assault), traumatic brain injury, younger and older ages, male, substance use, intellectual disability, cognitive impairment, type of procedure, high pain score, history of chronic pain, or sleep difficulties (falling asleep, remaining asleep, or waking up confused). **Day of procedure** · Adopt or develop a formal screening tool that facilitates an interview of the patient to identify risk factors absent from EMR.[5,17] · Meet with the high-risk patient and family to identify triggers that may influence or exacerbate a bout of delirium/agitation. For example, how the patient would prefer to be woken (e.g., softer voice, gender preference of staff, tapped on the shoulder) and what should be avoided (e.g., bright lights, music, male voice, tapping on legs).[20] · Implement a plan to help staff recognize the patient as having a delirium/agitation risk factor (e.g., unique colored surgical cap or bracelet). · Call ahead to procedure room to initiate intervention protocol for the high-risk patient.
Preoperative actions[2,16] (prior to incision or insertion of instrument)	**Adjust environment** · Strategies to reduce patient anxiety may include placement in a quiet room and away from high-traffic area, dim lights, and consolidate/limit staff interactions with patient (e.g., avoid unnecessary staff interactions, such as trainees, with high-risk patients).[20] · Prepare bed or table to prevent patient harm (e.g., lock wheels, pad siderails, mechanical restraints, secure arm boards and/or stirrups). · Secure IV with extra tape and then wrap with gauze. **Choice of anesthetics and/or adjunct agents, if medication is warranted for anxiety and/or pain** · Some sedative adjunct agents are associated with a higher rate of delirium/agitation, such as benzodiazepines.[3-5] For example, previous literature reported that benzodiazepines should be avoided with patients who have a history of PTSD.[2,16,21,22] · Alternatively, administration of dexmedetomidine and/or ketamine may reduce the likelihood and severity of delirium/agitation.[23-26] **Time-out** · Remind staff of patient's high-risk status for delirium/agitation. · Verbalize location of IV and type of airway (e.g., O2 mask, endotracheal tube).

Table 5 (continued).

Phases	Components
Intraoperative actions[2,16] (surgery/procedure is active; e.g., incision is open, instrument is inserted)	· Choice of maintenance anesthetic and/or adjunct agents can help to reduce the likelihood of emergence delirium/agitation (e.g., administer propofol or precedex rather than midazolam or administer TIVA as opposed to a gas agent).[5,10,23,25,27,28] · As case concludes, call ahead to recovery room/post-anesthesia care unit (PACU) to initiate intervention protocol for emergence of the high-risk patient.
Postoperative actions[2,16] (after the surgical site is closed and instrument is removed)	**Adjust environment** · Avoid triggers by reducing noise (music and metallic sounds during cleanup), dimming lights, and using patient's preferred method for emergence (e.g., softer voice, gender preference of staff, tapped on shoulder).[20,25] · Decrease height of stretcher or bed to provide staff with greater leverage in case the patient must be manually restrained (staff's hands-on restraint). Also, place siderails up with padding to help protect the patient and consider use of approved mechanical restraints. · Recovery unit/PACU should consider placing the patient in a private bay. **Choice of anesthetic and/or adjunct agents to prevent or treat delirium/agitation** · If needed and IV access is maintained, then consider more slowly reducing the dose of maintenance anesthetic and/or adjunct agents to slow the patient's emergence. If the patient begins to show early symptoms of delirium/agitation, then the dose of anesthetic and/or adjunct agent should be safely increased. · If IV access is maintained and the delirium/agitation symptoms significantly escalate, then consider a medication that will rapidly induce a sleeplike state. For example, consider administering propofol, as opposed to midazolam, to rapidly reduce delirium/agitation without exacerbating the bout. · If needed and if IV access is lost and the patient is still in the operating room, then consider administering a gas agent to re-sedate the patient and allow staff to reestablish IV access. **Staff support** · Consider proactively requesting additional staff for support during patient's emergence and until their return to baseline. · If needed, use a standardized code to request immediate staff assistance (e.g., anesthesia stat!). · If needed, staff should consider manual restraint of the patient (note: special training and technique are required to ensure patient and staff safety during hands-on restraint). · Staff must be prepared to protect IV access and maintain the airway. · If needed, consider attempting to orient the person by mentioning familiar people and places ("William, you are in Pittsburgh for a colonoscopy and your wife Mary is here too").
Post bout of delirium/agitation[2, 16]	· Debrief meeting with patient and family. · Debrief meeting among staff and discuss alternative explanations for the delirium/agitation. · Provide the patient with a prepared document to help them understand the bout of delirium/agitation and prior to discharge provide the patient with a referral to a mental health service.[20] Overall, assistance in helping the patient understand and mentally overcome the experience is important because patients who had a bout of delirium/agitation might be less likely to schedule a future procedure, which may have a long-term negative impact on their health (e.g., delayed diagnosis, treatment, and/or therapy). · File event report with patient safety office or risk management, and add a detailed note to the patient's EMR.

Additional considerations

- Staff who administer anesthetic and/or adjunct agents should be uniformly trained on all aspects of the intervention package. Also, consider including a simulation training component to enhance learning.[21,29]
- Develop a digital observation form to facilitate data collection that will allow staff and leadership to monitor and improve the effectiveness of the intervention.[30,31]
- Add a mandatory field to the post-anesthesia recovery note to facilitate staff's documentation of the patient's degree of delirium/agitation.
- For procedures where anesthesia services are typically not involved, but staff identify a patient as high-risk, they should consider requesting a consult from anesthesia for a broader range of sedation and treatment options, which could be more effective in preventing, treating, and de-escalating a bout of delirium/agitation.

Note: This intervention package is based on existing literature and ongoing practices at VA Pittsburgh Healthcare System (Project Golden Eagle). Readers should critically review the proposed intervention package prior to implementation because the package as a whole has not been experimentally evaluated for efficacy nor the risk of unintended consequences.

Limitations

We caution readers against interpreting our findings as being representative of the absolute frequency of perioperative delirium/agitation associated with an anesthetic and/or adjunct agent across Pennsylvania, as some events may go unreported. The event reports that were included in the study were reviewed and coded by only one of the authors; therefore, the extent of coding reliability is unknown. Also, few of the 97 event reports identified the specific anesthetic and/or adjunct agent that was administered to the patient, so we were unable to explore a relation between the type of medication and delirium/agitation (i.e., the report simply stated that "… the patient emerged from sedation…"). Furthermore, few of the reports provided adequate information to determine whether the intended level of sedation was moderate, deep, or general anesthesia. Finally, while other literature also proposed or recommended an intervention package similar to what we outlined in **Table 5**, there is a need for intervention research, including a component analysis, of the proposed intervention package.

Conclusions

The results show that delirium/agitation associated with anesthetics and/or adjunct agents occurred at many healthcare facilities, including hospitals and ambulatory surgical facilities. We expanded upon previous literature by measuring the frequency of delirium/agitation by operative period, which revealed that 8% of the events occurred preoperatively, 8% intraoperatively, and 84% postoperatively. We also found that intra- and postoperative periods were related with more severe patient behavior, injuries, and additional healthcare services or monitoring. These finding have notable implications for both patient and staff safety, and highlight the need for a robust intervention package to prevent, treat, and de-escalate bouts of delirium/agitation. With the proposed intervention package outlined in **Table 5**, we hope to advance the field of safety and prompt future research.

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Note

This analysis was exempted from review by the Advarra Institutional Review Board. The views expressed in this article do not represent the official views of the Department of Veterans Affairs or the U.S. government.

Correction: This article was corrected on December 13, 2021, to fix an incorrect percentage in the Discussion section referencing **Figure 3**.

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