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**Final Scholarly Project: General Anesthesia Clinical Practice Guidelines for Patients with
Posttraumatic Stress Disorder**

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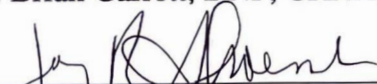
In Partial Fulfillment of the Requirements for the Degree

Doctor of Nursing Practice

DNP Final Scholarly Project Team:



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Abstract

General anesthesia is an induced state of unconsciousness administered by anesthesia providers to obtain patient amnesia, analgesia, and akinesia. Adult patients with posttraumatic stress disorder (PTSD) are at risk for general anesthesia-related complications throughout the perioperative setting. Emergence delirium is a clinically significant postoperative complication that patients with PTSD have an increased risk of developing. Postoperative complications of emergence delirium include patient or medical staff injury, surgical site damage, prolonged post-anesthesia care unit (PACU) stay, and increased medical care costs. Evidence demonstrates that implementing preventive interventions decreases the incidence of emergence delirium. There are no standardized, evidence-based general anesthesia guidelines for adult patients with PTSD. This project aimed to develop an evidence-based practice guideline for adult patients receiving general anesthesia with PTSD or at-risk for developing emergence delirium. A comprehensive literature search utilizing a PICO question was implemented to analyze and synthesize available evidence to develop the evidence-based guideline. Utilizing the Plan-Do-Study-Act (PDSA) quality improvement model, this project outlines a plan for implementing and evaluating the evidence-based practice guideline.

Keywords: general anesthesia, posttraumatic stress disorder, emergence delirium, perioperative

General Anesthesia Clinical Practice Guidelines for Patients with Posttraumatic Stress Disorder

Posttraumatic stress disorder (PTSD) is an anxiety disorder that develops after a traumatic event creating psychological trauma (Bisson et al., 2015). Almost seven percent of people in the United States will be diagnosed with PTSD within their lifetime (Wofford et al., 2012). Adult patients with PTSD are at risk for anesthesia-related complications throughout the perioperative setting (Lee & Sung, 2020). PTSD is associated with comorbidities that influence surgical morbidity and mortality, including depression, cardiovascular comorbidities, chronic pain, cognitive dysfunction, risky health behaviors, and psychoactive medications (Bisson et al., 2015; Wofford et al., 2012). Patients diagnosed with PTSD may experience postoperative complications that are refractory to conventional treatment interventions (Lovstrand et al., 2017). There are no standardized, evidence-based guidelines regarding anesthesia care for adult patients diagnosed with PTSD (Lovstrand et al., 2017)

Patients with PTSD should be assessed for cardiovascular risk factors, substance abuse, depression, and cognitive dysfunction before surgery due to the increased risk of surgical morbidity and mortality (Wofford et al., 2012). Patients with PTSD also have an increased risk of developing postoperative cognitive decline and complications after receiving general anesthesia (Wofford et al., 2012). Among these complications is the development of emergence delirium. Emergence delirium (ED) is an acute confusion state characterized by restlessness, disorientation, hallucinations, thrashing, non-purposeful movement, and agitation (Lee & Sung, 2020). The negative outcomes of ED secondary to PTSD after general anesthesia can be dangerous and lead to serious consequences (Lovstrand et al., 2017).

Consequences related to ED in patients with PTSD put both patients and medical care staff at risk. Patient or medical staff injury, surgical site injury or damage, prolonged post anesthesia care unit (PACU) stay, and increased medical care cost are all negative outcomes that can occur with ED (Lee & Sung, 2020; Umholtz et al., 2016). Perioperative interventions to mediate negative outcomes related to ED focus on preventive measures (Lovstrand et al., 2017). A multidisciplinary approach to the perioperative care of patients with PTSD is necessary to implement these preventive measures.

Background

Posttraumatic Stress Disorder

To further understand how PTSD and general anesthesia can lead to postoperative complications, PTSD must be defined, and the correlation between postoperative complications and PTSD identified. PTSD is a mental disorder that may develop after experiencing a traumatic event that creates psychological trauma (Bisson et al., 2015). Almost nine percent of people in the United States will be diagnosed with PTSD within their lifetime (Bisson et al., 2015). Manifestations of PTSD are characterized by four symptom groups, intrusion, avoidance, negative cognition and mood, and hyperarousal (American Psychiatric Association [APA], 2013). Pertinent symptoms include verbal or physical outbursts, exaggerated startle response, distorted cognition, negative emotional state, flashbacks, psychological distress, and marked physiological responses (Bisson et al., 2015). According to Bisson et al. (2015), “patients with PTSD are at increased risk of experiencing poor physical health, cardiorespiratory, musculoskeletal, gastrointestinal, and immunological disorders” (p.1). Additionally, patients with PTSD are at risk for anesthesia-related complications throughout the perioperative setting (Lee & Sung, 2020). PTSD is associated with comorbidities that influence surgical morbidity

and mortality, including depression, chronic pain, cognitive dysfunction, risky health behaviors, and psychoactive medications (Bisson et al., 2015; Wofford et al., 2012).

General Anesthesia

General anesthesia is an induced state of unconsciousness accompanied by partial or complete loss of protective reflexes, resulting from the administration of either intravenous or inhalational general anesthetic medications (Nagelhout & Elisha, 2017). Common inhalational general anesthetic medications otherwise known as volatile anesthetics include Desflurane, Sevoflurane, Isoflurane, and Nitrous Oxide (Nagelhout & Elisha, 2017). Nagelhout and Elisha (2017) state that Propofol is the standard medication used for induction of general anesthesia and the maintenance of intravenous sedation. The incidence of emergence delirium for patients with PTSD is affected by the anesthetic medications that are administered throughout the perioperative period.

Emergence Delirium

Emergence delirium is a known postoperative complication affecting approximately five to nineteen percent of patients after receiving general anesthesia (Lovestrand et al., 2017; Tolly et al., 2020). The incidence of emergence delirium increases in patients with PTSD, and symptoms are refractory to conventional treatment methods (Lovestrand et al., 2017). The terms emergence delirium and emergence agitation are often used interchangeably, although they are not equivalent (Lee & Sung, 2020). Emergence delirium is an acute confusion state in the recovery phase of anesthesia, symptoms including altered mental status, disorientation, hallucinations, restlessness, and hypoactive or hyperactive behaviors (Lee & Sung, 2020). Emergence agitation symptoms include restlessness, disorientation, confusion, hallucinations, thrashing, non-purposeful movement, and agitation in the acute recovery phase after general

anesthesia (Lee & Sung, 2020; Nguyen et al., 2016). As in previous studies, the terms emergence delirium and emergence agitation will be used interchangeably for this project.

Lee and Sung (2020) detail clinically significant postoperative complications that result from emergence delirium. These consequences include surgical site damage, accidental removal of drains or catheters, extubation, patient or staff injury, and increased medical costs. Patients who experience emergence delirium are also at an increased risk of prolonged postoperative delirium, which is associated with increased length of hospitalization, morbidity, and mortality (Lee & Sung, 2020).

There is no validated diagnostic tool for emergence delirium in adults; for the pediatric population, the Pediatric Anesthesia Emergence Delirium Scale can be utilized (Tolly et al., 2020). To assess emergence delirium in adults, symptom-based agitation scales (Appendix A) are used, including the Riker Sedation Agitation Scale (RSAS), Richmond Agitation-Sedation Scale (RASS), and Aono's 4-point Scale (Tolly et al., 2020). It is important to note that the primary screened outcome of the adult assessment scales is agitation compared to the Pediatric Anesthesia Emergence Delirium Scale (PAED), which assesses emergence delirium directly (Tolly et al., 2020).

Pathophysiology of Emergence Delirium

The pathophysiological mechanism of emergence delirium is unknown (Lee & Sung, 2020). According to Lee and Sung (2020), several hypothesized causes of emergence delirium exist. One potential explanation involves the recovery rate of function in the brain after the administration of inhalational anesthetics. Within the central nervous system, auditory and physical function return before cognitive function, potentially leading to emergence delirium (Lee & Sung, 2020). Another theoretical mechanism causing emergence delirium is the

manifestation of hyperarousal in response to stimuli in the excitatory phase of consciousness recovery after general anesthesia (Tolly et al., 2020). Although the exact mechanisms of emergence delirium are unknown, there are known factors identified in the literature that place patients at increased risk for developing emergence delirium (Lee & Sung, 2020).

Significance to Nurse Anesthesia

Patients diagnosed with PTSD are at risk for complications related to the administration of general anesthesia (Wofford et al., 2012). Emergence delirium is a clinically significant postoperative complication of general anesthesia (Lovstrand et al., 2017). Complications of emergence delirium include patient or medical staff injury, surgical site injury or damage, prolonged post anesthesia care unit (PACU) stay, and increased medical care costs (Lee & Sung, 2020; Umholtz et al., 2016). To improve clinical outcomes, a multidisciplinary approach to the perioperative care of patients with PTSD is necessary (Lovstrand et al., 2017). Identifying patients at risk for emergence delirium allows for preventative measures to be implemented by nursing and anesthesia care teams (Lovstrand et al., 2017). Anesthesia providers must utilize appropriate pharmacological and non-pharmacological interventions to reduce the incidence of emergence delirium (Lee & Sung, 2020). Collaboration between PACU nurses and anesthesia providers is essential in the treatment of emergence delirium and reduction in postoperative complications (Lovstrand et al., 2017).

Patients, healthcare providers, and healthcare organizations would benefit from clinical guidelines which bridge the information gap on anesthesia care for patients with PTSD. This project aims to create an evidence-based guideline that positively affects clinical outcomes for adult patients diagnosed with PTSD receiving general anesthesia.

Problem Statement

Utilizing the previously described problem, a PICO question was developed to direct a literature search. The PICO format was used to provide key search terms to obtain the best evidence for this project. The four components of a PICO question include population (P), intervention (I), comparison (C), and outcomes of interest (O) (Melnyk & Fineout-Overholt, 2019). In adult patients undergoing general anesthesia with a known diagnosis of PTSD (P), would the development and implementation of evidence-based practice guidelines related to the management of anesthesia in the perioperative period (I), compared to traditional practice (C), affect immediate postoperative complications specific to emergence delirium (O)?

Project Objectives

This project aims to develop evidence-based practice guidelines with a plan to implement and evaluate these guidelines. The four main objectives are listed below:

- Perform a systematic literature review and create evidence-based guidelines for adult patients with PTSD receiving general anesthesia.
- Develop a comprehensive plan to implement the guidelines, including dissemination of information and education related to practice guidelines.
- Develop a comprehensive plan to monitor and evaluate practice guidelines based on patient outcomes.
- Develop a comprehensive plan on how to adjust the guidelines if the outcomes are less than desirable.

Literature Review

A PICO question directed this project's literature search. PICO questions assist in the direction of projects by providing a framework for literature searches to answer specific questions related to a problem (Melnyk & Fineout-Overholt, 2019). The four components of the PICO question include population (P), intervention (I), comparison (C), and outcomes (O) (Melnyk & Fineout-Overholt, 2019). The PICO question developed for this project to guide the literature search is: In adult patients undergoing general anesthesia with a known diagnosis of PTSD (P), would the development and implementation of evidence-based practice guidelines related to the management of anesthesia in the perioperative period (I), compared to traditional practice (C), affect immediate postoperative complications specific to emergence delirium (O)?

A literature search was performed utilizing key search terms related to the PICO question. Databases searched included PubMed, CINAHL (EBSCO), MedLine, and Cochrane Library. Boolean operators “and” and “or” were used in conjunction with search terms to concentrate and strengthen search results. Search terms pertinent to the patient population (P) included: posttraumatic stress disorder, post-traumatic stress disorder, PTSD, anesthesia, and general anesthesia. Search terms for the intervention (I) included: anesthesia, practice guideline, prevention, medication, treatment, ketamine, dexmedetomidine, volatile, total intravenous anesthesia, and TIVA. Outcome search terms included: emergence, delirium, agitation, and complications. Over 50 articles were discovered with the relevant search terms, including meta-analyses, systematic reviews, randomized controlled trials, and cohort studies. Inclusion criteria included full-text articles, articles written in English, and articles published within the past six years. A literature summary table (Appendix C) was created to organize the data presented in each selected article after applying inclusion and exclusion criteria.

Risk Factors for Emergence Delirium

Wei et al. (2021) conducted a systematic review and meta-analysis to identify risk factors for adult emergence agitation after general anesthesia. This meta-analysis included eighteen studies involving 16,678 adult patients who received general anesthesia. Eighteen preoperative risk factors and nineteen intraoperative risk factors were meta-analyzed. Wei et al. (2021) conclude that male gender, smoking, urinary catheter placement, and postoperative pain are risk factors for emergence agitation. Other possible risk factors include inhalational anesthesia, history of substance misuse, intraoperative use of benzodiazepines, and advanced age (Wei et al., 2021). According to Melnyk and Fineout-Overholt (2019), this meta-analysis meets level I evidence criteria, providing high-level evidence on risk factors for adult emergence agitation after general anesthesia.

A prospective observational cohort study published by Munk et al. (2016) aimed to determine independent predictors of emergence delirium. The study included 1,970 adult patients emerging from general anesthesia and assessed these patients using the RASS. From using the RASS, 73 patients showed signs of emergence delirium (Munk et al., 2016). According to the study, 20 of the 73 patients exhibiting emergence delirium required additional staff to restrain the patient to avoid harm to the patient and staff (Munk et al., 2016). Multivariable logistic regression of selected variables identified and isolated independent predictors associated with emergence delirium (Munk et al., 2016). Munk et al. (2016) concluded that male sex, use of volatile anesthetics, and the presence of an endotracheal tube were significantly related to the incidence of emergence delirium. A noted limitation of this study is that it lacked randomization of the patient population compared to higher evidence

studies, such as randomized controlled trials (Melnyk & Fineout-Overholt, 2019; Munk et al., 2016).

Umholtz et al. (2016) published a retrospective cohort study in the *Journal of Clinical Anesthesia* regarding post-anesthesia emergence in patients with PTSD. This study's main objective was to determine the frequency of emergence delirium in veterans diagnosed with PTSD. Data was collected from 1,763 adult patients who received general anesthesia; of these patients, 317 had the diagnosis of PTSD (Umholtz et al., 2016). Statistical analysis included multivariable regression analysis, univariate analysis, 2-tailed Fisher exact tests, and non-parametric tests (Umholtz et al., 2016). Umholtz et al. (2016) conclude that PTSD is an independent predictor of emergence delirium, and patients with PTSD are at an increased risk for emergence delirium. A limitation of this study is that it is retrospective, and reporting bias is potential as providers documenting were not blinded to the diagnosis of PTSD (Umholtz et al., 2016).

Treatment, Prevention, and Management of Emergence Delirium

Lovestrand et al. (2017) published a meta-analysis in the *Journal of PeriAnesthesia Nursing* that focused on managing emergent delirium in adult patients with PTSD. This meta-analysis incorporated 33 studies and journal articles, including meta-analyses, systematic reviews, and randomized controlled trials. The study's main objectives included identifying risk factors for emergence delirium and creating an initial set of clinical guidelines for the pharmacologic and non-pharmacologic care of emergence delirium in the adult PTSD patient. According to Lovestrand et al. (2017), a multidisciplinary approach to the care of patients with PTSD who will receive general anesthesia is necessary. The management of emergence delirium starts with prevention. During the preoperative phase of care, it is essential to identify patients at

risk for emergence delirium with a thorough preoperative assessment (Lovestrand et al., 2017). The preoperative assessment should include medication reconciliation, history of PTSD or PTSD symptoms, anxiety assessment, and developing a trusting and consistent relationship between medical staff and the patient (Lovestrand et al., 2017). Intraoperative pharmacological recommendations include dexmedetomidine, clonidine, ketamine, promethazine, and droperidol to prevent and manage emergence delirium (Lovestrand et al., 2017). Postoperative recommendations include pharmacological, psychological, and emotional interventions. A quiet environment with reduced stimulus, pain and anxiety control, and prompt agitation assessment are essential in the acute post-anesthesia phase of care (Lovestrand et al., 2017). According to Melnyk and Fineout-Overholt (2019), this meta-analysis meets level I evidence criteria, providing high-level evidence on the management of emergence delirium in adult patients with PTSD.

Lee and Sung (2020) published a systematic review on emergence agitation in the Korean Journal of Anesthesiology. This systematic review incorporated 135 studies and journal articles, including meta-analyses, systematic reviews, and randomized controlled trials. The main objectives of this systematic review were to identify risk factors and strategies to prevent emergence agitation. Lee and Sung (2020) state, “effective emergence agitation prevention involves the identification of risk factors, elimination of correctable risk factors, and the application of pharmacological and non-pharmacological strategies on patients or during surgeries with high risks of emergence agitation” (p.479). Risk factors identified include advanced age, male gender, voiding urgency, inhalational anesthetics, rapid awakening from anesthesia, postoperative pain, and invasive devices, such as endotracheal tubes and foley catheter devices (Lee & Sung, 2020). Pharmacological interventions proven to decrease the

incidence of emergence agitation include the intraoperative use of ketamine, clonidine, dexmedetomidine, total intravenous anesthesia, regional anesthesia, multimodal analgesia, magnesium sulfate, and the avoidance of benzodiazepine premedication (Lee & Sung, 2020). Non-pharmacological interventions that effectively reduce emergence agitation incidence include patient education on surgical expectations of pain and early removal of indwelling devices (Lee & Sung, 2020). An appropriate assessment of risk factors and preventive strategies, including pharmacological and non-pharmacological interventions, reduces emergence agitation risk (Lee & Sung, 2020). According to Melnyk and Fineout-Overholt (2019), this systematic review meets level I evidence criteria, providing high-level evidence on emergence agitation.

Tolly et al. (2021) published a narrative review in the medical journal *Anesthesia & Analgesia*, primarily focusing on adult emergence agitation with a secondary focus on military veterans with PTSD. This review included twenty-seven randomized controlled trials and three prospective cohort studies on emergence agitation in adults. Tolly et al. (2021) state that the main objectives of this review are to analyze and synthesize current literature to determine emergence agitation risk factors, prophylactic measures, and management strategies. Risk factors for emergence agitation include diagnosis of PTSD, male gender, smoking, administration of volatile anesthetics, and ear, nose, and throat (ENT) surgical procedures (Tolly et al., 2020). Preoperative assessment of emergence agitation risk factors allows for preparation for emergence and implementation of prophylactic interventions (Tolly et al., 2020). Tolly et al. (2021) developed perioperative practice recommendations, including prophylactic pharmacological and non-pharmacological interventions. The use of dexmedetomidine, ketamine, multimodal analgesia, and avoidance of benzodiazepines throughout the intraoperative period reduces the incidence of emergence agitation (Tolly et al., 2020). Limitations of this narrative review

include inconsistencies in surgical populations and the use of multiple agitation diagnostic measures leading to a lack of standardization (Tolly et al., 2020). According to Tolly et al. (2021), the perioperative practice recommendations for adult emergence agitation they developed could be foundational for future studies to create a standardized management protocol.

Summary

Emergence delirium is a known postoperative complication after administering general anesthesia (Lovstrand et al., 2017). Patients with PTSD have an increased risk of experiencing emergence delirium (Umholtz et al., 2016). A thorough preoperative emergence delirium risk assessment identifies patients at high risk for emergence delirium (Tolly et al., 2020). Patients identified as high risk should receive prophylactic measures to prevent the incidence of emergence delirium (Lee & Sung, 2020). A multidisciplinary approach is required to implement these prophylactic measures throughout the perioperative setting (Lovstrand et al., 2017). In addition to a risk factor assessment, patient education and the development of a trusting relationship between patient and staff are important non-pharmacological interventions to decrease the risk of emergence delirium (Tolly et al., 2020). Evidence proves that the use of ketamine, dexmedetomidine, total intravenous anesthesia, and avoidance of benzodiazepines are critical components of a general anesthesia plan to prevent emergence delirium (Lee & Sung, 2020; Lovstrand et al., 2017). The development and implementation of evidence-based guidelines for patients with PTSD undergoing general anesthesia have the opportunity to improve the quality of care provided.

Evidence-Based Guideline

An evidenced-based clinical practice guideline was developed from information gathered from the literature search and review. This guideline is titled “General Anesthesia for Patients with Posttraumatic Stress Disorder,” and is listed in Appendix B. The purpose of the guideline is to provide evidence-based practice recommendations regarding the delivery of general anesthesia for the patient with PTSD. This guideline has three sections focusing on preoperative, intraoperative, and postoperative care.

Initial patient assessment within the preoperative care unit will include a preoperative assessment focused on identifying at-risk patients. During the preoperative interview of the patient, psychiatric history, medications, and past anesthetic history will be reviewed by nursing staff and anesthesia providers. Patient triggers for emergence delirium prophylaxis include a prior history of emergence delirium or a diagnosis of PTSD. Pharmacological interventions implemented within the preoperative phase of care for at-risk patients include the avoidance of benzodiazepines. A thorough explanation of the perioperative process and expectations should be discussed with the patient and any family or visitors present. Consistent staff should be utilized for at-risk patients to increase familiarity and trust. Additional measures include securing intravenous catheters with extra tape to prevent unintended removal.

During the timeout at the beginning of the intraoperative period, the anesthesia provider will state that a patient is at-risk for emergence delirium. The anesthesia provider has multiple pharmacological options to implement throughout the intraoperative period to prevent incidence of emergence delirium. The anesthesia provider can administer Total Intravenous Anesthesia if deemed appropriate. Additional adjunctive medications should be administered depending on clinical appropriateness. The anesthesia provider should consider the administration of

dexmedetomidine or ketamine. Dexmedetomidine may be administered by bolus or infusion; example dosing is provided in Appendix B. Subanesthetic ketamine dosing is also provided in Appendix B. Anesthesia emergence preparation includes quieting the operating room, dimming the lights, and transferring the patient to a cart or stretcher with side rails prior to emergence.

A quiet and private recovery room or bay should be provided to at-risk patients for emergence delirium. The Richmond Agitation-Sedation Scale (RASS), seen in Appendix A, will be utilized to assess agitation in the postoperative patient. This assessment will occur every five minutes for three occurrences. Reorientation, active listening, and validation of experiences are nursing interventions to implement in the postoperative period. Relief of postoperative symptoms, including pain, discomfort, and nausea, should be carried out by nursing staff implementing pharmacological and non-pharmacological interventions.

Quality Improvement Model

Plan-Do-Study-Act (PDSA) Cycle

The framework for this project is the Plan-Do-Study-Act (PDSA) cycle, also known as the Deming cycle (Finkelman, 2017). The PDSA cycle is an effective scientific method that allows for continual improvement through its four-stage process (Finkelman, 2017). The four-stage process allows for intervention development, implementation, analysis, and refinement (Melnik & Fineout-Overholt, 2019). Evidence-based quality improvement projects can integrate the PDSA model to systematically implement practice changes (Melnik & Fineout-Overholt, 2019). Combining the PDSA cycle with external evidence supporting practice changes increases the effectiveness of proposed changes (Melnik & Fineout-Overholt, 2019). The PDSA cycle was chosen as the framework for this project due to the structured and cyclical format, which effectively improves desired outcomes (Moran et al., 2020).

PDSA Cycle: Plan

The first stage of the PDSA cycle (Plan) involves identifying a problem, developing a change plan, and defining outcomes (Finkelman, 2017). Initial inquiry indicates no standardized, evidence-based guidelines regarding anesthesia care for adult patients diagnosed with PTSD at a Midwest, urban, level-one trauma medical center. External evidence was collected through a comprehensive literature search to investigate the identified problem further. The literature synthesis establishes an opportunity to reduce postoperative complications for PTSD patients by implementing specific anesthesia care interventions. This project aims to develop evidence-based anesthesia practice guidelines focused on reducing postoperative emergence delirium in patients with PTSD.

PDSA Cycle: Do

The second stage of the PDSA cycle (Do) includes the implementation of the plan and the observation of how the plan is working (Agency for Healthcare Research and Quality [AHRQ], 2021). Proposed implementation of the constructed practice guidelines for anesthesia care of patients with PTSD will occur in the perioperative setting at a Midwest, urban, level-one trauma medical center. Project implementation will involve anesthesia providers, pharmacy personnel, preoperative, operating room, post-anesthesia care unit (PACU) nursing staff, and the appropriate quality department at the medical facility.

PDSA Cycle: Study

The third stage of the PDSA cycle includes gathering and analyzing data after the implementation stage (AHRQ, 2021). Project leaders will obtain results and data from the implementation trial in conjunction with the quality department. Collecting patient outcome data allows for measuring the impact of the proposed clinical practice guidelines. Obtaining feedback

from anesthesia providers and perioperative nursing staff leads to a further understanding of outcome data. Dissemination of results and feedback to key stakeholders at the healthcare facility will occur to facilitate the fourth stage of the PDSA cycle.

PDSA Cycle: Act

The fourth stage of the PDSA cycle (Act) is the adjustment of proposed changes based on knowledge gained from the implementation trial (AHRQ, 2021). The PDSA cycle is designed to be repeated, allowing for continual improvement (Finkelman, 2017). Project leaders will use knowledge and information gained from the implementation and study stages to refine or modify clinical practice guidelines to achieve desired outcomes (Finkelman, 2017). Following the fourth stage, future modifications to guidelines can be planned and implemented following the PDSA cycle for sustained quality improvement.

Comprehensive Implementation Plan

The setting for the proposed implementation of this final scholarly project (FSP) is a level 1 trauma hospital located in the Midwest. The project focuses on perioperative units within this hospital, including the preoperative, intraoperative, and postoperative settings. Anesthesiologists and Certified Registered Nurse Anesthetists (CRNA) will provide anesthetic care for patients during the perioperative phases of care. Nursing staff, pharmaceutical staff, and the quality department for the perioperative setting will be included in implementing the created evidence-based guideline.

Implementation

Stage One: Plan

The FSP lead has designed a proposed implementation plan for the future. To implement this plan, the associate project team will utilize the four-step process of the PDSA quality

improvement model. The implementation plan will discuss the initial problem identification stage, developing a change plan, and defining outcomes. A literature search and analysis were completed by the FSP lead to create an evidence-based guideline on General Anesthesia for Patients with Posttraumatic Stress Disorder (Appendix B). Future associate project leaders will review the literature search, analysis, and the developed evidence-based guideline. Additional research will need to be completed by the associate project team to discover if any new evidence relating to the PICO question has been published. Once the associate project team has familiarized themselves with available research and adjusted the guidelines as needed, the second step of the PDSA quality improvement model can be enacted.

Stage Two: Do

The second stage of the PDSA quality improvement model includes the implementation of the created evidence-based guideline. The second step to implement this project at a future facility involves educating staff and key stakeholders. Education regarding the guideline will be presented to key stakeholders, including but not limited to anesthesia providers, perioperative nursing staff, perioperative pharmacists, and appropriate quality improvement staff. Associate project leaders will provide in-person educational meetings for each department regarding guidelines. Education for preoperative nursing staff will specifically include information on new nursing surgical handoff forms and educational sheets for preoperative interventions. The anesthesia providers' education will focus on identifying at-risk patients, pharmacological interventions, surgical timeout process, and general anesthesia emergence preparation. Postoperative nursing staff will be educated on the necessary postoperative assessments and non-pharmacological interventions to provide for at-risk patients. Pharmaceutical staff will be included in educational meetings as indicated to ensure appropriate stocking of medication

dispensing machines, specifically the medications dexmedetomidine and ketamine. The quality department will be educated on desired outcomes and will monitor outcomes and adherence related to the implemented guideline so clinical analysis can be completed.

Stage Three: Study

The third stage of the PDSA quality improvement model includes studying the implemented change plan. Throughout the implementation period, the quality department will monitor and analyze adherence and outcomes data related to the guideline. This analysis will occur on a bi-weekly basis. Specific outcomes that the quality department would include in the analysis are documented RASS scores in the acute postoperative phase, administration of rescue medications during emergence, unintended patient removal of lines, tubes, or drains, and patient staff or injury. The frequent analysis of outcomes data will allow for prompt intervention if outcomes are less than desirable. The four-month initial implementation phase will allow for the assessment of continued adherence to the guideline. The quality department will assess adherence to the guideline, including surgical handoff form compliance, pharmacological interventions utilized, and RASS charting completed by nursing staff in the PACU. The four-month implementation period will also allow for a larger sample size of patients to be treated with the evidence-based guideline. Comprehensive outcomes data will allow for a greater understanding of the guideline and the effects that implementation of the guideline has on patients. The associate project team lead will receive data from the quality department throughout the outcomes data collection and analysis period of implementation. This communication will occur over secure email correspondence. At the end of month four, the associate project team will meet with the quality department to discuss patient outcomes data and guideline adherence.

Stage Four: Act

The PDSA quality improvement model's fourth stage includes adjusting or adopting proposed changes based on outcomes. After the fourth month of implementation, the associate project team will meet with the quality department to review patient outcomes data collected throughout the implementation. If the implemented guideline is ineffective in reducing postoperative complications related to emergence delirium in patients in the specified population, appropriate revisions and changes to the included interventions can be introduced. After guideline revisions, a reimplementation stage can be implemented utilizing the cyclical nature of the PDSA quality improvement model. If there is less than desirable difference in patient outcomes, guideline implementation can be redacted, and traditional practice resumed. The quality department will monitor adherence and usage of the guideline to ensure the guideline is utilized appropriately. If adherence is not satisfactory, further education will be provided to personnel not adhering to the guideline.

Outcomes Analysis

Patient Outcomes Data

Primary clinical outcomes that will be monitored include RASS scores in the acute postoperative phase, administration of rescue medications during emergence, and patient staff or injury during emergence or the immediate postoperative period. RASS scoring is detailed in Appendix A and will be documented by postoperative nursing staff every five minutes for three occurrences in the postoperative recovery room. Goal RASS scores are less than or equal to a plus one on the RASS scale. Administration of rescue medications during emergence or in the immediate recovery phase of general anesthesia will include medications utilized for emergence delirium, agitation, combativeness, or hyperactive behaviors. Secondary clinical outcomes

monitored will include unintended removal of lines, tubes, or drains during emergence. The quality department will collect these data points bi-weekly throughout the implementation of the proposed guideline.

Baseline Data

A review of past electronic medical record (EMR) analysis of adult patients with PTSD who received general anesthesia over the previous year will be conducted. Specific data collected will include the following:

- Incidence of preoperative assessment of emergence delirium risk.
- Documented RASS scores in the immediate postoperative recovery phase of care.
- Incidence of rescue medications administered during emergence or in the immediate postoperative recovery phase of care.
- Incidence of unintended patient removal of lines, tubes, or drains during emergence or in the immediate postoperative recovery phase of care.
- Incidence of patient staff or injury during emergence or in the immediate postoperative recovery phase of care.

Baseline data collected will be compared to post-implementation data during analysis completed by the quality department.

Post-Implementation Data

During and after the implementation of the evidence-based guideline, data will be collected through EMR analysis. Data collected will include the following:

- Incidence of preoperative assessment of emergence delirium risk.
- Documented RASS scores in the immediate postoperative recovery phase of care.

- Incidence of rescue medications administered during emergence or in the immediate postoperative recovery phase of care.
- Incidence of unintended patient removal of lines, tubes, or drains during emergence or in the immediate postoperative recovery phase of care.
- Incidence of patient staff or injury during emergence or in the immediate postoperative recovery phase of care.
- Adherence and compliance to the implemented evidence-based guideline and pharmacological interventions administered.

Data Analysis

Data will be analyzed by comparison of post-implementation outcomes data and baseline retrospective data. Statistical analysis and comparison of baseline and post-implementation data will assess the effectiveness of the evidence-based guideline in reducing postoperative complications related to emergence delirium. Analysis of documented RASS scores in the immediate postoperative recovery phase of care will include average RASS scores and the trend over time of RASS scores postimplementation of the guideline. Incidence of rescue medication use, unintended patient removal of lines, tubes, or drains, and patient or staff injury during emergence will be collected and analyzed. This analysis will include monthly percent change of incidence of the selected categories. Findings of data analysis and guideline adherence will be communicated with associate project team leaders.

Timeline

The timeline for associate project team leaders to implement the evidence-based guideline at a future facility will occur over an initial ten-month timeframe. The first month of project implementation will focus on the education of staff. After the education phase on the

guideline, months two through five will begin the initial implementation and outcomes monitoring period. Throughout the implementation period, the quality department will monitor and analyze adherence and outcomes data related to the guideline. Based on outcomes data and adherence to the implemented guideline, adoption or adaptation of the guideline would occur in month six. If the implementation of the guideline provides desired outcomes, adoption of the implemented guideline can occur. If outcomes are less than desirable, guideline adjustment may occur, followed by a reimplementation phase. Throughout the reimplementation phase, outcomes data and analysis will continue to be monitored by the quality department. Due to the cyclical nature of the PDSA quality improvement model, the guideline can continue to be implemented and adjusted until desired outcomes are obtained.

Figure 1

Timeline

Months	1	2	3	4	5	6	7	8	9	10	11	12
Education												
Implementation												
Data Collection/ Analysis												
Adjustment of Guideline												
Reimplementation												

Budget

The budget for the project includes expected expenses for the implementation and monitoring of the guideline. The main expenditure for the project is adjunctive pharmacological medications, specifically dexmedetomidine and ketamine. The price per unit for dexmedetomidine ranges from \$1.43 - \$1.50 for 200 vials of 80mcg/20ml (4mcg/ml) in 0.9%

sodium chloride for a total price of \$285.75 – \$299.89 (Drugs.com, n.d.-a). The price per unit of ketamine is \$0.84 for 200 vials of 200mg/20ml (10mg/ml) for a total price of \$167.80 (Drugs.com, n.d.-b). In addition to the current pharmaceutical stock at the medical facility, it is important to expand available stock to account for the increased utilization of dexmedetomidine and ketamine. The incidence of adult patients with PTSD who undergo surgery with general anesthesia is difficult to estimate; the lifetime occurrence of PTSD is nine percent (Bisson et al., 2015). It is reasonable to account for an approximate ten percent increase in the usage of dexmedetomidine and ketamine to ensure sufficient stock of medications. This surplus of available medication will allow for implementing adjunctive pharmacological interventions within the guideline. An initial order of 200 vials of both dexmedetomidine and ketamine will total \$467.89 and can be repeated as necessary throughout the implementation of the guideline.

There will be minimal budgetary impact for dissemination and education regarding the guideline. An estimated \$50 will be allotted for paper materials to present information regarding the guideline, and this cost includes informational handouts and a poster. Dissemination of information will occur at weekly staff meetings and will not incur additional costs. Additional material costs may be incurred if surgical handoff forms are not utilized at the proposed facility. The proposed implementation setting for this project utilizes surgical handoff forms, and adjusting these to include the guideline-specific intervention will not increase costs.

Discussion with the pharmacy and its representatives will be necessary to determine the impact of expanding dexmedetomidine and ketamine stock in the medication dispensing machines. There is potential cost related to the increased stocking needs of dexmedetomidine and ketamine, such as the need for rearranging medication dispensing machines and increased

medication stocking personnel workflow. This labor increase is expected to be minimal and not significantly impact pharmacy workflow.

Organizational costs related to quality department monitoring and analysis are difficult to estimate. Utilization of quality department resources will be necessary throughout the implementation and analysis of the guideline. Quality department workflow tasks include data collection, analysis, and dissemination of information to the associate project team. Costs related to quality department utilization will be determined during the educational meeting regarding the guideline that includes representatives from the appropriate quality department.

Conclusion

A comprehensive literature search confirmed that adult patient with PTSD are at an increased risk for emergence delirium after receiving general anesthesia. Currently, there are no standard evidence-based guidelines for adult patients with PTSD who are receiving general anesthesia. Synthesis of current literature concluded that there are pharmacological and non-pharmacological interventions that can decrease the incidence of postoperative complications and emergence delirium in adult patients with PTSD. A clinical practice guideline was developed to guide the implementation of pharmacological and non-pharmacological interventions to reduce the risk for emergence delirium in high-risk patients. A proposed plan for implementation, evaluation, and guideline revision was created utilizing the quality improvement model, the Plan-Do-Study-Act (PDSA) cycle.

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Appendix A

Emergence Agitation Scales Used in Adult Studies

Name	Primary Screened Outcome	Scale Categories	Common Positive Scale ³⁶
Riker Sedation Agitation Scale (RSAS) ²⁶	Agitation	7 levels (1) Unarousable (2) Very sedated (3) Sedated (4) Calm + cooperative (5) Agitated (6) Very agitated (7) Dangerous agitation	≥5
Richmond Agitation-Sedation Scale (RASS) ²⁷	Agitation	10 levels (-5) Unarousable (-4) Deep sedation (-3) Moderate sedation (-2) Light sedation (-1) Drowsy (0) Alert + calm (+1) Restless (+2) Agitated (+3) Very agitated (+4) Combative	≥+1
Aono's 4-point scale ²⁸	Agitation	4 levels (1) Calm (2) Not calm but could be easily calmed (3) Not easily calmed; moderately agitated or restless (4) Combative, excited, or disoriented	≥3
Pediatric Anesthesia Emergence Delirium (PAED) Scale ²⁵	ED; validated in Pediatrics ^a	5 categories (1) Eye contact (2) Purposeful actions (3) Awareness (4) Restlessness (5) Inconsolability Depending on category, 0–4 points assigned for “not at all” “just a little”	≥10–12 summation of all 5 categories

“quite a bit”
“very much,” “extremely”

(Tolly et al., 2020, pp. 353-364)

Appendix B

GUIDELINE DRAFT	
TITLE: General Anesthesia for Patients with Posttraumatic Stress Disorder	NUMBER:
ISSUE DATE:	EFFECTIVE DATE:
DEVELOPED/REVISED BY: Brad Closson	
REVIEWED BY:	DATE REVIEWED:
APPROVED BY:	

STATEMENT OF PURPOSE:

The purpose of this guideline is to provide evidence-based practice recommendations regarding the delivery of General Anesthesia for the patient with Posttraumatic Stress Disorder (PTSD). Patients with PTSD have an increased risk for perioperative complications, including emergence delirium. Prophylactic pharmacological and non-pharmacological interventions can be taken to reduce the risk for emergence delirium and should be implemented for patients identified as high risk.

DEFINITIONS:

- **General Anesthesia:** Induced state of unconsciousness accompanied by partial or complete loss of protective reflexes, resulting from the administration of either intravenous or inhalational general anesthetic medications.
- **Posttraumatic Stress Disorder:** PTSD is diagnosed when an individual has experienced a traumatic event and develops symptoms in response to that traumatic experience. Symptomology includes intrusion symptoms, avoidance symptoms, negative alterations in mood and cognition, and marked alterations in arousal and reactivity.
- **Emergence Delirium:** Acute confusion state in the recovery phase of anesthesia, symptoms including altered mental status, disorientation, hallucinations, restlessness, and hypoactive or hyperactive behaviors.

GUIDELINES:

1. Preoperative

- **Preoperative assessment**
 - Identification of at-risk patients
 - Review of past anesthetics for emergence delirium episodes
 - Electronic medical record (EMR)

- Preoperative interview of patient
 - Assess psychiatric history and medications
 - **Triggers for emergence delirium prophylaxis**
 - Prior history of emergence delirium
 - Formal PTSD diagnosis
 - **Preoperative non-pharmacological interventions**
 - Develop a trusting relationship
 - Explain perioperative process
 - Include family/visitors
 - Consistency of staff
 - Including Nursing and Anesthesia providers
 - Secure Intravenous Catheters with extra tape
 - **Pharmacological interventions**
 - Avoid the administration of benzodiazepines
- 2. Intraoperative**
 - Include increased emergence delirium risk in timeout
 - **Pharmacological interventions**
 - Consider the administration of
 - Total Intravenous Anesthesia (TIVA)
 - Dexmedetomidine
 - Infusion or bolus dosing
 - Example infusion dosing: 0.5 mcg/kg over 10 minutes after induction and 0.5 mcg/kg/hr through emergence
 - Ketamine
 - Subanesthetic dosing
 - Give early in the intraoperative period, consider subsequent small doses every hour
 - Example dosing: 0.2-0.5 mg/kg bolus, with or without an infusion of 5-120 mcg/kg/min
 - **Emergence preparation**
 - Quiet room with dim lighting
 - Transfer patient to stretcher with side rails prior to emergence
- 3. Postoperative**
 - Provide a quiet and private recovery bay
 - Utilize reorientation and grounding measures
 - Active listening and validation of experiences
 - Symptom relief
 - Including pain, discomfort, and nausea
 - Assessment with Richmond Agitation-Sedation Scale (RASS)
 - Q 5 min x3 in the immediate postoperative period

Guideline References:

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Appendix C

Literature Summary Table

Citation	Design	Sample/Setting	Methods	Findings (Statistical findings or qualitative findings)	Level of Evidence
<p>Jo, J.-Y., Jung, K.-W., Kim, H.-J., Park, S.-U., Park, H., Ku, S., & Choi, S.-S. (2019). Effect of total intravenous anesthesia vs volatile induction with maintenance anesthesia on emergence agitation after nasal surgery. <i>JAMA Otolaryngology–Head & Neck Surgery</i>, 145(2), 117. https://doi.org/10.1001/jamaoto.2018.3097</p>	<p>Randomized clinical trial</p>	<p>80 adult patients undergoing nasal surgery.</p>	<p>Emergence agitation was measured by the Richmond Agitation Sedations Scale (RASS) for patients receiving total intravenous anesthesia (TIVA) or volatile induction and maintenance of anesthesia with sevoflurane.</p>	<p>Emergence agitation after nasal surgery under general anesthesia can be reduced by using total intravenous anesthesia rather than inhalation anesthesia.</p>	<p>II</p>
<p>Lee, S.-J., & Sung, T.-Y. (2020). Emergence agitation: Current knowledge and unresolved questions. <i>Korean Journal of Anesthesiology</i>, 73(6), 471–485. https://doi.org/10.4097/kja.20097</p>	<p>Systematic review</p>	<p>135 studies and journal articles relating to emergence agitation.</p>	<p>This review discusses the important themes of EA, including incidence, risk factors, mechanisms,</p>	<p>Risk factors for emergence agitation include, advanced age, male gender, voiding urgency, inhalational anesthetics, rapid awakening from</p>	<p>I</p>

			prevention, and management.	anesthesia, postoperative pain, and presence of invasive devices Total intravenous anesthesia (TIVA), propofol, alpha 2-agonists, regional analgesia, multimodal analgesia, avoidance of benzodiazepine premedication, and preoperative education help in preventing emergence agitation.	
<p>Lovestrand, D., Lovestrand, S., Beaumont, D. M., & Yost, J. G. (2017). Management of emergence delirium in adult ptsd patients: Recommendations for practice. <i>Journal of PeriAnesthesia Nursing</i>, 32(4), 356–366. https://doi.org/10.1016/j.jopan.2015.11.011</p>	Meta-Analysis	Synthesis of 34 journal articles relating to PTSD and anesthesia, and one textbook related to nursing skills.	Synthesis of available literature, combined with evidence-based principles were utilized to develop an initial set of guidelines for adult patients with PTSD receiving general anesthesia.	Care of the patient with PTSD who exhibits ED risk factors requires a multidisciplinary approach. Preoperative identification of patients at risk for emergence delirium allows staff to plan for potential ED and minimize risk factors. Effective medications currently used for ED include	I

				dexmedetomidine, clonidine, ketamine, promethazine, and droperidol.	
Munk, L., Andersen, G., & Møller, A. M. (2016). Post-anaesthetic emergence delirium in adults: Incidence, predictors and consequences. <i>Acta Anaesthesiologica Scandinavica</i> , 60(8), 1059–1066. https://doi.org/10.1111/aas.12717	Prospective cohort study	1,970 adult patients undergoing general anesthesia included in the study with 73 patients experiencing signs of emergence delirium.	Statistical analysis of independent predictors of ED was implemented with multivariable logistic regression of selected variables.	Male sex, volatile anesthetics, and ETT were factors significantly related to ED.	IV
Tolly, B., Waly, A., Peterson, G., Erbes, C. R., Prielipp, R. C., & Apostolidou, I. (2021). Adult emergence agitation: A veteran-focused narrative review. <i>Anesthesia and Analgesia</i> , 132(2), 353–364. https://doi.org/10.1213/ANE.00000000000005211	Narrative review	30 studies were included focused on emergence agitation and veterans with PTSD	30 studies were reviewed to define emergence agitation, determine risk factors for EA, and prevention strategies.	Preoperative assessment and risk factor identification allow for minimization of risk for emergence agitation. Pharmacological prevention strategies include the use of dexmedetomidine, ketamine, TIVA, and avoidance of midazolam pre-operatively.	V

<p>Umholtz, M., Cilnyk, J., Wang, C. K., Porhomayon, J., Pourafkari, L., & Nader, N. D. (2016). Postanesthesia emergence in patients with posttraumatic stress disorder. <i>Journal of Clinical Anesthesia</i>, 34, 3–10. https://doi.org/10.1016/j.jclinane.2016.02.047</p>	<p>Retrospective cohort study</p>	<p>Perioperative information of 1,763 patients who underwent a surgical procedure requiring general anesthesia.</p>	<p>A total of 317 patients were identified with a positive history of PTSD and were compared to 1,446 patients without history of PTSD history of. Incidence of emergence delirium in the post-anesthesia care unit (PACU) were compared between the two groups.</p>	<p>Posttraumatic stress disorder independently predicted the frequency of emergence delirium.</p>	<p>IV</p>
<p>Wei, B., Feng, Y., Chen, W., Ren, D., Xiao, D., & Chen, B. (2021). Risk factors for emergence agitation in adults after general anesthesia: A systematic review and meta-analysis. <i>Acta Anaesthesiologica Scandinavica</i>. https://doi.org/10.1111/aas.13774</p>	<p>Systematic review/meta-analysis</p>	<p>Eighteen observational studies involving 16,678 adult patients were included in this study.</p>	<p>Eighteen preoperative factors and nineteen intraoperative factors were meta-analyzed. This meta-analysis aimed to define the risk factors for adult emergence agitation after general anesthesia and provide recommendations for clinical practice.</p>	<p>Male gender, smoking, urinary catheter placement, and postoperative pain are noted risk factors of emergence agitation. Advanced age, use of inhalational anesthesia, history of substance misuse, and intraoperative use of benzodiazepines are possible risk factors for adult emergence agitation.</p>	<p>I</p>