Implementation of an Anesthesia Practice Change to Impact Postoperative Cognitive Dysfunction

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Abstract

Problem: Approximately 25-40% of patients over the age of 60 who undergo anesthesia experience postoperative cognitive dysfunction (POCD) at hospital discharge, and 10% continue to suffer from this complication 3 months postoperatively. Devastating physical and financial outcomes occur including prolonged hospital stays, higher rates of readmission, financial stress and dependence, as well as increased mortality. Intraoperative administration of dexamethasone and dexmedetomidine are evidence-based effective strategies to reduce the incidence of POCD. **Purpose:** The purpose of this Quality Improvement (QI) project is to implement an anesthesia practice change to impact the incidence of POCD. The overall goal is to increase adherence to the administration of intraoperative dexamethasone and dexmedetomidine for patients who are identified preoperatively as high-risk for POCD through screening. **Methods:** Through collaboration with anesthesia leadership and other key stakeholders, a site-specific intraoperative checklist was developed to illustrate the anesthesia practice change. Anesthesia providers were prompted to evaluate results of the preoperative screening; patients with a positive screening result, indicating a higher risk of developing POCD, should be administered at least one of the evidence-based interventions listed on the intraoperative checklist. Administration of these interventions were documented on a paper checklist and collected for data analysis. **Results:** Pre-implementation rates of dexamethasone and/or dexmedetomidine administration to patients aged 60 or older was compared to post-implementation rates of administration to high-risk individuals. Post-implementation findings demonstrate an overall adherence of 93.8% to the anesthesia practice change. **Conclusions:** Intraoperative administration of dexamethasone and/or dexmedetomidine is a safe, effective, and feasible strategy to reduce the risk of POCD in high-risk surgical patients.

Implementation of an Anesthesia Practice Change to Impact Postoperative Cognitive Dysfunction

Postoperative cognitive dysfunction (POCD) is a transient disturbance in cognition that develops after anesthesia, manifesting as memory impairment and poor task performance, which is diagnosed through psychometric testing (Evered & Silbert, 2018). Nationally, the incidence of POCD at hospital discharge for adults 60 years and older is approximately 25-40%, while the incidence 3 months post-operatively is approximately 10% (Evered & Silbert, 2018). Physical and financial outcomes of POCD include prolonged hospital stays, slower rehabilitation, higher rates of readmission, financial stress and dependence, as well as increased mortality (Zywiel et al., 2013). Elevated serum S100B protein levels, a marker of neuronal degeneration, have been identified in patients with POCD (Valentin et al., 2016). Elderly patients are considered high-risk for POCD as advanced age is an independent risk factor. While there are limited research-based guidelines from professional organizations for the management of POCD, results from several well-designed, well-conducted randomized-controlled studies demonstrate the favorable impact of intraoperative dexmedetomidine and dexamethasone on effectively reducing the incidence of POCD.

Anesthesia providers at a 182-bed regional medical center have observed an increase in the periodic occurrences of POCD in patients aged 60 and older after non-emergent surgical procedures. At this project site, approximately 1500-2500 patients undergo elective surgeries each year that are considered high-risk for POCD. Assuming the prevalence of POCD at the project site is reflective of the national average, a significant number of site patients are potentially experiencing this disorder, necessitating intervention. However, this project site lacks standardized evidence-based intraoperative practice guidelines. Provider attitudes towards a

practice change in this regard, and organizational support for the initiative are favorable. Therefore, a Quality Improvement project was developed to increase adherence to intraoperative dexamethasone and dexmedetomidine for patients who are identified preoperatively as high-risk for POCD through screening.

Literature Review

Support for an anesthesia practice change is based on a comprehensive synthesis of existing evidence. The literature reviewed supports the administration of dexamethasone before general anesthesia to reduce the incidence of POCD and the administration of dexmedetomidine during sedation and general anesthesia to reduce the incidence of POCD. The review includes one level I meta-analysis of randomized controlled studies, and two level II studies (Melnyk & Fineout-Overholt, 2019). These studies were selected for their similar target population of adult patients, similar surgical setting, and goal of reducing POCD incidence. The level I study was given a B rating for consistent results and use of the same measuring tool across studies; however, the author failed to include specific study protocols (Newhouse, 2006). The level II study by Mei et al. (2018) was given an A for being adequately powered and ensuring assessors were blinded (Newhouse, 2006). Lastly, the level II study by Valentin et al. (2016) was given a B rating for meeting adequate power and including blinded anesthesia providers and assessors, however, the researchers also included depth of anesthesia as a variable and utilized several different cognitive tests to measure POCD (Newhouse, 2006).

Valentin et al (2016) conducted a randomized controlled trial to determine the effect of dexamethasone on the incidence of POCD. Subjects were randomly assigned to no dexamethasone or 8 mg intravenous dexamethasone before undergoing general anesthesia; subjects in each group were also randomly assigned to different depths of anesthesia as measured

by a bispectral index (BIS) monitor (Valentin et al., 2016). The researchers concluded that patients who received dexamethasone and lighter anesthesia, measured by higher BIS values, demonstrated the lowest incidence of POCD, measured through a variety of cognitive tests, as well as no long-term deficit in delayed recall or executive functioning evaluated six months postoperatively.

Mei et al. (2018) and Zhou et al. (2016) examined the incidence of POCD in patients who received dexmedetomidine during both general anesthesia and sedation. Mei et al. (2018) measured POCD incidence by comparing mini-mental status exam (MMSE) scores before and after surgery for patients randomly assigned to receive dexmedetomidine or propofol for sedation during total hip arthroplasty. Patients in the meta-analysis conducted by Zhou et al. (2016) received dexmedetomidine or saline, and were also assessed for POCD through comparison of pre- and post-operative MMSE scores. In both pieces of evidence, it was determined that patients who received dexmedetomidine scored more favorably on the MMSE postoperatively and experienced a lower incidence of POCD.

A final consideration in the literature is the level of S100B protein levels in subjects who received dexamethasone intraoperatively, despite the level of anesthesia, because the protein is a marker of neuronal degeneration and may be linked to higher incidence of POCD. Valentin et al. (2016) compared S100B protein levels pre- and post-operatively in subjects receiving dexamethasone and those who did not, and with varying degrees of depth of anesthesia. The dexamethasone group, regardless of depth of anesthesia, had lower S100B protein levels than those subjects who did not receive dexamethasone (Valentin et al., 2016). Valentin et al. (2016) concluded that dexamethasone reduces neuronal damage and thus the incidence of POCD.

All studies included in the review support the use of dexamethasone and

dexmedetomidine to prevent POCD in older adults. Two of the three studies evaluated POCD with MMSE exam scores, while the other study utilized a combination of cognitive tests. One study uniquely included depth of anesthesia as another variable that may potentially impact POCD. Another study evaluated POCD with serum markers of neurological injury and correlated these levels with various cognitive tests. Overall, the evidence is strong and supports a change in anesthesia practice to reduce the incidence of POCD.

Theoretical Framework

The Theory of Unpleasant Symptoms (TOUS) by Lenz (1997) is a middle range theory that aids understanding of the clinical problem of POCD and the relationships among and between factors and symptom experiences (Lenz et al., 1997). This theory consists of three major concepts which include symptoms that individuals experience, influencing factors that affect the experience of the symptom, and consequences of experiencing the symptom (Lenz et al., 1997). Cognitive dysfunction is an unpleasant symptom that often leads to poor cognitive performance and psychological distress. Factors known to contribute to this experience include deep levels of anesthesia, long-acting anesthetic agents, and inflammation from surgical stress. Administration of dexamethasone and/or dexmedetomidine by anesthesia providers as proposed in this project is hypothesized to decrease inflammation, reduce the incidence of the unpleasant symptom, and improve postoperative performance and cognitive function.

The implementation process framework by Helfrich et al. (2007) postulates that successful implementation of change is a function of managerial support and availability of resources, often mediated by organizational climate, innovation champions, and the relationship between user's values and the change. Through discussions with the site team, support was demonstrated for the practice change with buy-in and commitment from change champions. Medications and supply

resources were readily available in each operating room and no additional man-power resources were required for the initiative. The organizational climate can be described as open to change and supportive of utilizing evidence-based recommendations for practice. Furthermore, the innovation supports patient wellness and recovery, which aligns with the values of anesthesia providers at this regional medical center. The combination of these influencing factors gave strong reason to believe implementation of this QI project will be successful.

Methods

The setting for this quality improvement project included 9 operating rooms of a regional medical center, where 1500-2500 surgeries are performed annually. Eligible patients for the project included adults age 60 or older, undergoing non-emergent surgery who required general anesthesia or sedation, and screened positive preoperatively using the Mini-Cog Screening Tool. Measures were taken to ensure methods of screening and intraoperative implementation were ethical and no population was excluded; translator phones were immediately available to patients without English proficiency and sensory aids were available to patients who required them. To ensure all eligible patients were included, the number of recorded data packets collected each week was compared with the number of patients meeting eligibility criteria according to the operating room schedule.

Prior to the project, a site team was mobilized, the context of the organization was assessed, and the project was planned with stakeholders. A team of 8 anesthesiologists, 18 certified registered nurse anesthetists (CRNAs), and 9 student registered nurse anesthetists (SRNAs), who provide perioperative anesthesia care to surgical patients, was assembled. The project was designated Non-Human Subjects Research by the University of Maryland Institutional Review Board (IRB) and Medstar Health Research Institute IRB. Following IRB

approval, the project commenced with education of the anesthesia providers on the efficacy of dexamethasone and dexmedetomidine on reducing the incidence of POCD was completed using an in-person power point presentation. Providers who were not present received education in person over the following two weeks.

Following training all anesthesia providers were responsible for identifying high-risk patients preoperatively using the Mini-Cog Screening Tool. These high-risk patients were eligible for the new practice involving the administration of intravenous dexamethasone and/or dexmedetomidine. Documentation of the administration in the Intraoperative Anesthesia Practice Change Table from the POCD packet was included in the patient record (Appendix B).

Strategies to promote adherence to the anesthesia practice change included securing buy-in from key stakeholders on how these medications improve patient outcomes, and seeking guidance from the providers on how to develop a process that would be feasible at this project site. Tactics to gain buy-in included presenting high-quality research that demonstrates how dexamethasone and dexmedetomidine reduce the incidence of POCD as well as identifying change champions, publishing biweekly performance updates, and providing nutritional incentives.

The structure measure to track implementation progress included education of anesthesia providers, the POCD packet, and a mechanism to document in the patient record. Anesthesiologists, CRNAs, and SRNAs were educated on the effect of administration of 4-8 mg of intravenous dexamethasone, as well as dexmedetomidine infusions 0.1-0.5 mcg/kg/hr, on reducing the incidence of POCD. Receipt of education was tracked in an electronic spreadsheet until 100% of staff and students were educated. The process measure to track progress involved adherence to the anesthesia practice change. This measure was evaluated by comparing the

number of eligible patients who received the intraoperative medications with the total number of patients eligible to receive medications. Adherence to the practice change was defined by the administration of at least one of the two medications.

Data collection involved anesthesia providers placing all completed POCD packets with documentation of dexamethasone and/or dexmedetomidine to high-risk patients in a locked storage bin in the postoperative recovery area, only accessible by the project lead. No patient identifying information was included on the packets. Packets were collected weekly by the DNP project lead, all project data was recorded in a secure data management spreadsheet, and stored in a password protected computer to maintain confidentiality (Appendix C).

Results

Results from this QI project demonstrated the successful implementation of an intraoperative anesthesia practice change that aimed to reduce the risk of POCD in a high-risk patient population. Several structure and process changes were made to achieve an average adherence of 93.8% to the intraoperative practice change. Within two weeks of initiating implementation, 100% of anesthesia providers were educated on the practice change, and each rotating SRNA received education upon beginning their new clinical rotation. The power point presentation was distributed electronically to review as needed.

Project data was collected and analyzed weekly, and illustrated with the use of a run chart (Appendix D). A total of 96 data points were collected over the project, reflecting the total number of high-risk patients identified preoperatively, eligible to receive the intraoperative medications. A total of 90/96 patients received at least one of the two intraoperative medications. Analysis of the data over time illustrated a weekly adherence range of 0-100%. The astronomical point of zero adherence during week 6 was due to relocation of the POCD packets in the

preoperative area without notifying the DNP project lead. Shortly after anesthesia providers were unable to locate the POCD packets, the DNP project lead was made aware, and the packets were replaced with an easily identifiable sign. Analysis of the run chart data revealed no shifts or trends, and an insufficient number of runs for the number of data points collected; therefore, no special-cause variation can be concluded. However, during project implementation, with the exception of week 6, the number of older adult patients receiving preventative medications was higher than pre-implementation baseline administration.

One barrier to project implementation was short staffing due to the COVID-19 pandemic, reducing time in the preoperative setting to perform risk stratification through screening. Additionally, at this facility, new SRNAs rotate for clinical training every 1-2 months. Education was difficult to complete for newly rotating SRNAs until after their first week, when the DNP project lead was notified of their arrival. Another important barrier involved provider fears regarding the side effects of dexamethasone and dexmedetomidine. Anesthesia providers were concerned that dexamethasone would raise blood glucose levels in diabetic patients, and that dexmedetomidine would delay emergence in older patients. Finally, dexmedetomidine is only available in the operating room at this facility in an undiluted form. As a result, if providers choose to administer dexmedetomidine they must gather supplies and mix it themselves, which requires additional time and planning. Unexpected facilitators of the implementation included the SRNAs. They were frequently responsible for implementation and encouraged anesthesia staff to implement the anesthesia practice change.

Discussion

This quality improvement project provides initial support for the feasibility of administering dexamethasone and/or dexmedetomidine intraoperatively to patients with an

increased risk of developing POCD. Implementation was successful during 7 out of 12 weeks, meeting the process goal of 100% adherence to the intraoperative practice change. Goals were met as a result of anesthesia provider recognition of the benefits of dexamethasone and dexmedetomidine on risk reduction demonstrated in the literature. Additionally, these medications were easy to administer and readily availability in all operating rooms. The success of this anesthesia practice change may also largely be attributed to an already established protocol at this facility for preventing postoperative nausea and vomiting (PONV), which includes the administration of intravenous dexamethasone. Both intraoperative medications have been well demonstrated in the literature to reduce the incidence of POCD; therefore, this quality improvement project may impact patient outcomes by reducing the risk of POCD development.

The facility's cultural emphasis on quality improvement helped to facilitate the implementation. While dexamethasone is commonly administered intraoperatively for its anti-emetic property, the current initiative to address PONV prophylaxis was a unique facilitator to high project adherence. Conversely, a threat to internal validity was demonstrated by provider biases on the side effects of dexamethasone and dexmedetomidine. Efforts to mitigate these biases included reeducation with high-quality evidence demonstrating the safety of low dose dexamethasone in diabetic patients, as well as the safety and efficacy of dexmedetomidine in elderly patients undergoing sedation and general anesthesia.

Imprecision of project design was evident in the inconsistent presence of POCD packets in the preoperative area. Inadequate communication between anesthesia leadership, preoperative nursing leadership, and the DNP project lead, led to a decrease in patient screening and project implementation as a result of POCD packet relocation. Restricted nursing involvement in the project by the site due to workload demands and the pandemic was a limitation as well. Making

preoperative nurses aware of the project may have prevented this complication. Further efforts to minimize limitations include continuous collaboration with the CSR and change champions.

Conclusion

Postoperative cognitive dysfunction is a distressing complication that may affect a significant portion of the surgical population at this facility each year. Intraoperative administration of dexamethasone and/or dexmedetomidine is a safe and effective, evidence-based practice to reduce POCD. The practice change was designed in collaboration with anesthesia leadership to reduce the risk of POCD for high-risk patients in the intraoperative setting. Administration of these medications presents a feasible and cost-effective strategy to improve recovery and patient outcomes for high-risk surgical patients.

A formal POCD prevention protocol to identify and treat high-risk patients could promote practice change sustainability, especially considering the success of the current PONV protocol. Additionally, incorporating POCD prevention into new SRNA orientation may make the practice change more permanent as SRNAs played an integral role during implementation both administering the medications and empowering other anesthesia providers to participate in the project. Many surgical procedures performed on older adult patients in the operating rooms at this facility are quick, and do not require prolonged or heavy anesthesia. Benefits from this intraoperative practice change could be spread other environments including the electrophysiology lab, where the majority of patients are over the age of 60 and under anesthesia for a considerably longer period.

This quality improvement project helped raised awareness on the impact of POCD in older patients and how a simple change in practice can influence postoperative recovery. Future research ecould compare Mini-Cog screening results at 6 and 12 months postoperatively with

preoperative screening results to assess the long-term outcomes of these intraoperative strategies. Overall, this quality improvement project demonstrated the collaborative success of an implementation team to enhance the quality of anesthesia care delivered to high-risk patients.

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Zhou, C., Zhu, Y., Liu, Z., & Ruan, L. (2016). Effect of dexmedetomidine on postoperative cognitive dysfunction in elderly patients after general anaesthesia: A meta-analysis. *Journal of International Medical Research, 44*(6), 1182-1190. DOI:

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Zywiel, M.G., Prabhu, A., Perrucio, A.V., & Gandhi, R. (2013). The influence of anesthesia and pain management on cognitive dysfunction after joint arthroplasty: A systematic review. *Clinical Orthopaedics and Related Research, 472*(5)*,* 1453-1466. DOI 10.1007/s11999-013-3363-2

Table 1

Evidence Review Table

Citation: Zhou, C., Zhu, Y., Liu, Z., & Ruan, L. (2016). Effect of dexmedetomidine on postoperative cognitive dysfunction in elderly patients after general anaesthesia: A meta-analysis. *Journal of International Medical Research, 44*(6), 1182-1190. DOI: 10.1177/0300060516671623					Level I
Purpose/ Hypothesis	Design	Sample	Intervention	Outcomes	Results
The purpose of this meta-analysis was to "examine the efficacy of dexmedetomidine for the prevention of POCD in elderly patients, so as to inform future clinical decision making."	Meta-analysis of 13 randomized controlled studies, screened and selected by two researchers.	**Search Strategy:** A search for relevant RCTs was conducted using PubMed, EMBASE, Cochrane Library, China Academic Journals full-text database, and Google Scholar. A combination of subject terms and free text were used including "dexmedetomidine," "postoperative cognitive dysfunction," "POCD," and "general anaesthesia." 564 studies were initially identified as relevant and then screened for methodologic quality based on a modified Jadad scale. Two researchers independently screened the studies and consulted a third party when needed to resolve disagreements on eligibility. Reasons for inclusion and Jadad scores were documented on the included studies. **Eligible Studies:** Randomized controlled	**Control:** Administration of physiologic saline. **Intervention:** Administration of intravenous dexmedetomidine. **Protocol:** Not described for each study.	**DV:** Postoperative cognitive dysfunction defined as "clinical manifestations including cognitive function disorder, personality change, and memory impairment; in severe cases, Alzheimer's disease." **Measure:** The dependent variable was measured through Mini-mental status exam scores (MMSE), a frequently used tool to evaluate postoperative cognitive function. Ten RCTs reported incidence of POCD on POD1, 7 RCTs reported incidence of POCD after POD1, and 6 RCTs reported MMSE scores on POD1. Authors did not discuss the reliability or validity of the MMSE tool.	**Level of measurement:** A fixed effect model to pool relative risk ratios was used for meta-analysis if no heterogeneity was found among studies using a combination of the chi-square and I^2 tests. **Outcome Data Retrieval:** Data from all selected articles was pooled for analysis. **Analysis:** After ruling out any substantial heterogeneity between 10 RCTS assessing for POCD on POD1 ($P=0.36$, $I^2=9\%$), researchers found a relative risk (RR) of 0.59 (95% CI, 0.45-0.76, $p<0.0001$). After ruling out substantial heterogeneity between 7 RCTs assessing incidence of POCD after POD1 ($P=0.36$, $I^2=9\%$), researchers found a relative risk of 0.66 (95% CI 0.45-0.98, $p=0.04$). After ruling out substantial heterogeneity between 6 RCTs assessing MMSE scores on POD1 ($I^2=43\%$), the mean difference in MMSE scores between groups was 2.12. **Conclusions:** No significant difference in incidence of POCD on POD1 between groups. However, those who received dexmedetomidine intraoperatively were 0.6 times less likely to develop POCD after POD1 and more likely to have

		trials of patients undergoing general anesthesia with an intervention of single or continuously-administered intravenous dexmedetomidine prior to and during anesthesia. Studies with a main outcome indicator of cognitive dysfunction on and after postoperative day one, and mini-mental status exam scores on postoperative day one (POD1). **Excluded:** 551 studies were excluded for (1) lack of specific exclusion data or only demonstrated exclusion data with figures and tables (2) duplicate publications (3) use of dexmedetomidine formulations not commonly available (4) incomplete data or information (5) full text not available. **Included:** 13 randomized controlled trials with the administration of dexmedetomidine as the intervention during general anesthesia to adult patients. **PRISMA:** Included brief, not detailed decision-making criteria for retaining or omitting studies. **Power analysis:** No power analysis was performed.			higher MMSE scores indicating less POCD on POD1. **SR Bias:** Researchers reported no publication bias as evidenced by a symmetrical funnel plot analysis.
Citation: Valentin, L.S.S., Pereira, V.F.A., Pietrobon, R.S., Schmidt, A.P., Oses, J.P., Portela, L.V., Souza, D.O., Vissoci, J.R.N., Luz, V.F., Trintoni, L.M.A.S., Nielson, K., & Carmona, M.J.C. (2016). Effects of single low dose					Level II

of dexamethasone before noncardiac and nonneurologic surgery and general anesthesia on postoperative cognitive dysfunction: A phase III double blind, randomized clinical trial. *PLoS ONE, 11*(5), 1-12. DOI:10.1371/journal.pone.0152308					
Purpose/ Hypothesis	Design	Sample	Intervention	Outcomes	Results
The purpose of this study was to "evaluate the effect of dexamethasone on the incidence of postoperative cognitive dysfunction in elderly patients undergoing surgery under general anesthesia."	Randomized, double-blind, prospective clinical trial.	**Sampling Technique:** Convenience **Eligible Participants:** Adults aged 60 and older undergoing elective non-cardiac and non-neurologic surgery. **Excluded:** Expected surgical time > 6 hours, history of brain disease/dementia/psychiatric disorders affecting cognition, illiterate, preoperative use of corticosteroids/opioids/ antidepressants. **Accepted:** 140 adults patients undergoing elective surgery under general anesthesia. A computer randomization program was used to allocate patients into groups and subgroups; these assignments were recorded on paper, sealed in envelopes, and opened by the anesthesia provider in the operation room. **Control:** 72 patients, none lost to follow-up. **Intervention:** 68 patients, none lost to follow-up. **Power Analysis:** A sample size of 136 patients was required to achieve a power	**Intervention Protocol:** Before induction of general anesthesia, patients received 8 mg of intravenous dexamethasone. These patients were then randomly assigned into subgroups with different bispectral index (BIS) targets, 46-55 or 35-45. **Control Protocol:** Patients did not receive dexamethasone before induction of anesthesia. These patients were also randomly assigned into subgroups with different BIS targets, 46-55 or 35-45. **Treatment Fidelity:** Cognitive assessments were performed on all patients 1 day before surgery, and on POD 3, 7, 21, 90 & 180. Anesthesia	**Dependent Variable:** Postoperative cognitive function and serum S100B protein levels. **Measure:** Cognitive function was measured with the Telephone Interview for Cognitive Status (TICS), Neuropsychological Battery Test, Rey-Auditory Verbal Learning Test (RAVLT), Symbol Digit Modified Test (SDMT), and the Trail Making Test (TMT); cognitive functions assessed included spatial and temporal orientation, mental control, memory, language, calculations, and executive functioning. A diagnosis of POCD was made if the TICD score was < 27, and at least 1 of 8 potential deficits identified by the other cognitive assessment tools was identified. S100B protein levels were measured with an	**Statistical Results:** The Generalized Estimation Equation (GEE), general linear mixed modeling, and Bonferroni comparisons were used to analyze the results between groups and timing of assessments. Patients who received dexamethasone and lighter anesthesia demonstrated the lowest incidence of POCD throughout the study. These patients also showed no deficit in delayed recall or executive function on POD180. Patients who did not receive dexamethasone and were in the deeper anesthesia group demonstrated the highest incidence of POCD on POD3 and POD 180 (68.2%, $p<0.0001$ and 25.3%, $p<0.0001$ respectively). This group also demonstrated the greatest cognitive dysfunction via the TMT test on POD180 (77.5%, $p<0.0001$). Serum S100B protein levels were significantly higher postoperatively in the no dexamethasone group, regardless of anesthetic depth.

		of 80%, alpha was set at 0.05. The study was adequately powered, minimizing the risk of type II error. **Group Homogeneity:** Patient demographics were assessed and no statistically significant differences were found between groups.	providers were unblinded to BIS and dexamethasone group assignments, however, patients, neuropsychologists, lab technicians and researchers assessing outcomes were blinded until after statistical analyses were performed. Induction and maintenance of anesthesia were identical between groups. Serum S100B protein levels were obtained prior to induction of anesthesia and 12 hours postoperatively.	enzyme-linked immune absorbent assay (ELISA) kit.	
Citation: Mei, B., Meng, G., Xu, G., Cheng, X., Chen, S., Zhang, Y., Zhang, M., Liu, X., & Gu, E. (2018). Intraoperative sedation with dexmedetomidine is superior to propofol for elderly patients undergoing hip arthroplasty. *Clinical Journal of Pain, 34*(9), 811817. DOI: 10.1097/AJP.0000000000000605					Level II
Purpose/ Hypothesis	Design	Sample	Intervention	Outcomes	Results
The purpose of the study was to "compare the influence of two supplemental intraoperative sedative drugs (propofol and dexmedetomidine) to peripheral	Prospective randomized controlled study.	**Sampling Technique:** Convenience **Eligible:** Adult patients 65 years or older undergoing total hip arthroplasty, ASA I-IV. **Excluded:** Patients who have a contraindication to lumbosacral plexus or T12 paravertebral blocks	**Intervention Protocol:** For sedation during the procedure, before the regional block, patients were administered a bolus of Dexmedetomidine 0.8 to 1 mcg/kg	**Dependent Variable:** Incidence of POD and POCD, postoperative pain, length of stay, ambulation after surgery, postoperative complications within 30 days of surgery. **Measure:** Incidence of POD was measured	**Statistical Results:** The chi-square test was used to measure frequency data, which included POD incidence. Fewer patients in the dexmedetomidine group exhibited POD than the propofol group, Odds ratio 0.41 (95% CI, 0.20-0.88, p-0.03). The Mann-Whitney U Test was used to assess the difference between pre- and

nerve block on the incidence of postoperative delirium (POD) in elderly patients undergoing hip arthroplasty [and] the influence of these two drug sedative drugs on the incidence of early POCD." Mei et al. (2018) "hypothesized that intraoperative sedation with dexmedetomidine, as a supplemental to regional anesthesia (RA), would be associated with a lower incidence of POD and positive postoperative outcomes compared with intraoperative sedation with propofol."		(coagulopathy, puncture site infection, refusal), mental deficit, language barrier, anesthesia in last 30 days, severe congestive heart failure (New York Heart Association class IV), severe Chronic Obstructive Pulmonary Disease, sick sinus syndrome, severe sinus bradycardia (<50), heart block that is second degree or greater without pacemaker, pre-existing cognitive impairment (MMSE ≤ 24), and/or preoperative delirium (positive Confusion Assessment Method [CAM] result). **Accepted:** 336 patients undergoing total hip arthroplasty. All patients were planned to receive a peripheral nerve block, and a computer-generated randomization program assigned participants to either the control or intervention group. **Control:** 169 patients; 6/169 were lost due to cancelled surgery, 13/169 were lost due to failed peripheral nerve block, and 2 were lost to follow-up due to death during the first 30 days postoperatively or refusal to follow-up.	over 15 to 20 minutes, followed by an infusion at 0.1-0.5 mcg/kg/hr. **Control Protocol:** For sedation during the procedure, before the regional block, patients were administered a target-controlled infusion of propofol with effect site concentration set to 0.8-1 mcg/mL. **Treatment Fidelity:** Vital signs and monitoring were established upon entry to the operating room. Sedation was initiated, and 30 minutes later, the regional block was performed. Sedation was discontinued upon completion of the surgery and patients recovered in the post anesthesia care unit. Two individuals within the department were trained to perform the POD	with the CAM assessment between POD1 and POD3. Early POCD was assessed with the MMSE on POD3 and POD7.	postoperative MMSE scores. Patients in the dexmedetomidine group had higher MMSE scores than the propofol group on POD3 (mean ± SD: 25.2 ± 3.3 for the dexmedetomidine group and 21.3 ± 4 for the propofol group, $p<0.001$) and POD7 (mean ± SD: 24.9 ±3.6 for the dexmedetomidine group and 23.1 ± 3.2 for the propofol group, $p<0.001$).

		Intervention: 167 patients; 5/167 were lost due to cancelled surgery, 10/167 were lost due to failed peripheral nerve block, and 4 were lost to follow-up due to death during the first 30 days postoperatively (1), incorrect contact information (1), and refusal to follow-up (2). **Power analysis:** 148 participants were required per group to maintain a power of 90%, alpha was set at 0.05. The study was adequately powered, minimizing the risk of type II error. **Group homogeneity:** Patient demographics were assessed and no statistically significant differences were found between groups.	and POCD assessments, they were blinded to group assignment.		

Note. Evidence level for the studies were assigned using the "Rating System for the Hierarchy of Evidence for Intervention/Treatment Questions" (Melnyk & Fineout-Overholt, 2019, p. 11)

Table 2

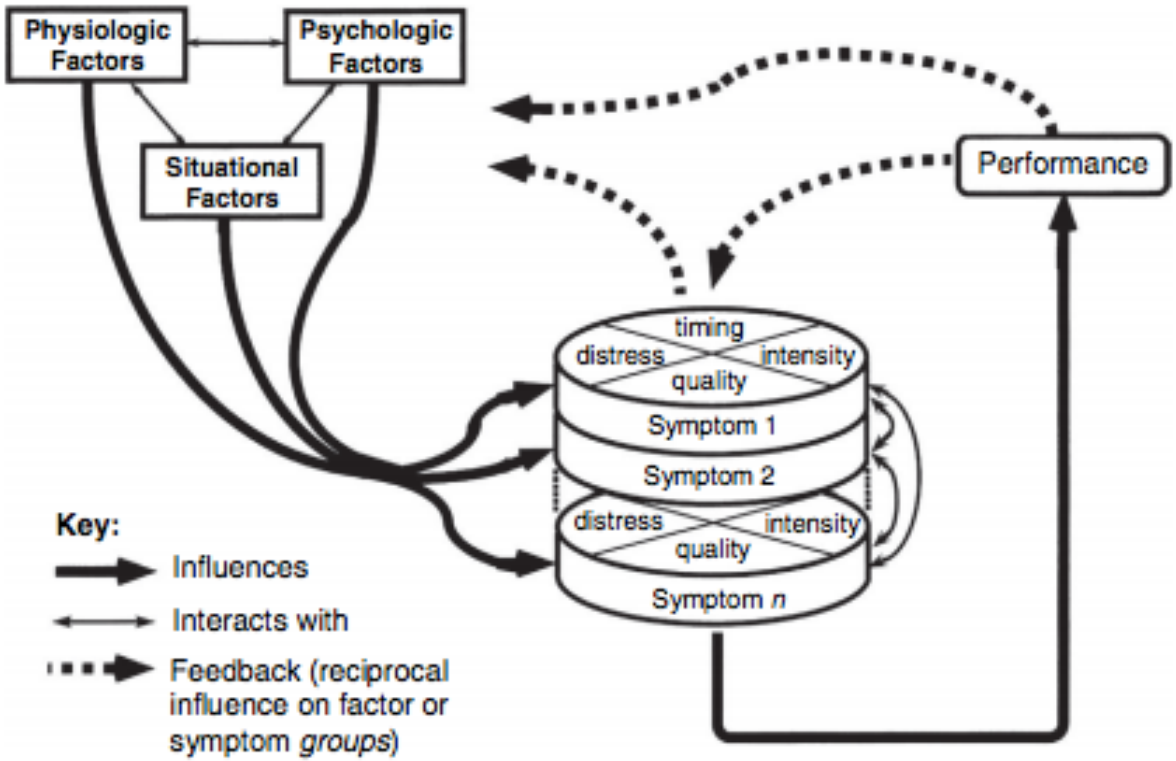
Evidence Synthesis Table

Evidence Based Practice Question (PICO): In adult patients undergoing anesthesia for elective procedures, does the intraoperative use of intravenous dexmedetomidine, dexamethasone, or magnesium sulfate affect the incidence of postoperative cognitive dysfunction?			
Level of Evidence	**# of Studies**	**Summary of Findings**	**Overall Quality**
I	**1**	Zhou et al. (2016) found that administering intravenous dexmedetomidine during general anesthesia reduced the incidence of POCD. Patients who received dexmedetomidine compared to placebo were less likely to develop POCD and more likely to have higher MMSE scores.	B, the authors described a thorough, reproducible search strategy, and only included randomized controlled trials. Outcomes were measured with the same tool across studies and results were consistent across studies. However, no specific study protocols were included for comparison and Zhou et al. (2016) report that the doses and methods of dexmedetomidine administration varied substantially across studies.
II	**2**	Mei et al. (2018) also found that intravenous dexmedetomidine reduced the incidence of POCD, compared to propofol. However, this effect was measured after its use for sedation instead of as an adjunct to general anesthesia. Postoperative MMSE scores were significantly higher in the dexmedetomidine group. Valentin et al. (2016) found that patients who received dexamethasone before induction and were maintained with a lighter depth of anesthesia had the lowest incidence of cognitive dysfunction compared to patients who received dexamethasone and greater depth of anesthesia, and both groups who did not receive dexamethasone. Additionally, postoperative serum S100B protein levels were significantly higher in patients who did not receive dexamethasone before induction.	A, this was an adequately powered, randomized controlled study with a sufficient sample size. Trained and blinded assessors increased validity of the results. Results are consistent with existing literature. B, this was an adequately powered, double blind, randomized controlled study with a sufficient sample size. The literature review is not extensive, and validity of the effect from dexamethasone would be improved by eliminating the depth of anesthesia as a variable. Definitive results were made with the utilization of several cognitive tests. Additionally, of all studies included in this review, participants in this study had the longest follow-up with testing performed six months after surgery, demonstrating long term effects of the intervention.

Note. Quality level for the studies was assigned using the "Rating Scale for Strength and Quality of Evidence" (Newhouse, 2006, p. 339).

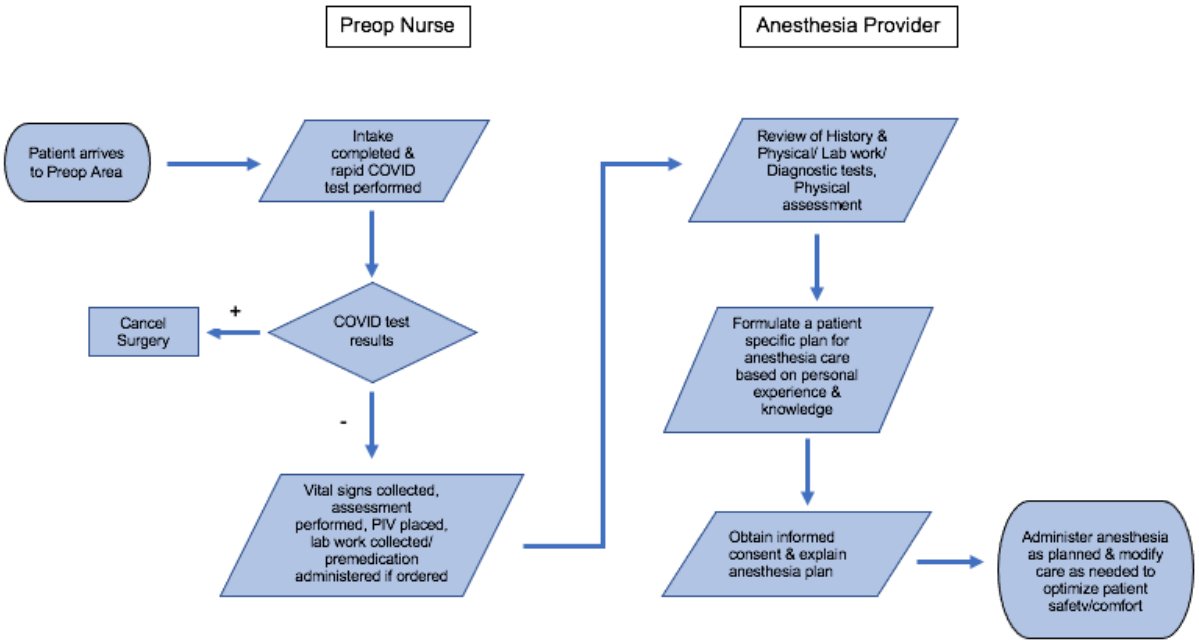
Figure 1

Theoretical Framework Diagram



Appendix A

Current Process Flow Map



Appendix B

Intraoperative Anesthesia Practice Change

Intraoperative Anesthesia Practice Change (Please circle yes/no responses below)		
Did patient screen high risk for POCD based on the Mini-Cog?	Yes	No
If yes, did you administer: • Dexamethasone 4-8 mg IV • Dexmedetomidine IV infusion or bolus	 Yes Yes	 No No
If you did not, please give a rationale:		

Appendix C

Data Collection Tool

Week of Data Collection	Number of eligible patients who received ≥ 1 medication from the Intraoperative Anesthesia Practice Change	Number of eligible patients who received Dexamethasone	Number of eligible patients who received Dexmedetomidine	Number of patients eligible for Intraoperative Anesthesia Practice Change	Adherence (%)
8/1-8/7					
8/8-8/14					
8/15-8/21					
8/22-8/28					
8/29-9/4					
9/5-9/11					
9/12-9/18					
9/19-9/25					
9/26-10/2					
10/3-10/9					
10/10-10/16					
10/17-10/23					
10/24-10/30					
10/31-11/6					
11/7-11/13					
11/14-11/20					
11/21-11/27					
11/28-12/4					
12/5-12/11					
12/12-12/18					

Appendix D

Adherence to Intraoperative POCD Prevention Practice Change Run Chart