Marian University

Leighton School of Nursing

Doctor of Nursing Practice

Final Project Report for Students Graduating in May 2024

Ondansetron Prior to Subarachnoid Anesthesia in Parturient Patients Undergoing Cesarean Section to Decrease Hypotension: A Practice Change Guideline

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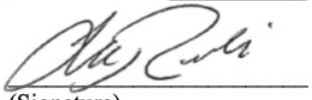
Chair: Dr. Lee Ranalli



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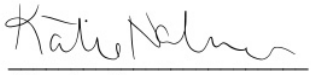
Project Team Member: Katie Holmer



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Abstract

Background: Cesarean sections account for 31% of all births annually, with spinal anesthesia being the preferred method of anesthesia. The side effects from spinal anesthesia in the parturient include hypotension, bradycardia, and vasodilation. The medication ondansetron, when administered before spinal anesthesia, can help mitigate some side effects of spinal anesthesia.

Purpose: This DNP project was developed to educate anesthesia providers on the benefits of administering ondansetron before spinal anesthesia in a parturient scheduled for a cesarean section.

Methods: This DNP project collected quantitative and qualitative data through electronic pre-tests and post-tests. An evidence-based educational intervention was conducted with a retrospective chart review.

Implementation: Five anesthesia providers at a rural hospital in northern Indiana participated in this project. The providers were given a pre-test and then, one-on-one, provided with education from a PowerPoint presentation. Following the presentation, a post-test was administered. Additionally, a retrospective chart review was conducted three months before and three months after the educational intervention to determine if a practice change had been made regarding the timing of ondansetron administration.

Conclusion: The introduction of an educational intervention improved anesthesia providers' knowledge on the benefits of ondansetron before spinal anesthesia in parturients, with a statistically significant ($p < 0.001$) increase in pre-test to post-test scores. Additionally, a retrospective chart review indicated that before the educational intervention, ondansetron was given 0% of the time before spinal anesthesia in parturients, and following the educational intervention, it was increased to 50% of the time before spinal anesthesia.

Keywords: Zofran, ondansetron, spinal, spinal anesthesia, neuraxial anesthesia, cesarean section, cesarean delivery, Bezold-Jarisch, and sympathectomy

Ondansetron Prior to Subarachnoid Anesthesia in Parturient Patients Undergoing Cesarean Section to Decrease Hypotension: A Practice Change Guideline

This project is submitted to the faculty of Marian University Leighton School of Nursing as partial fulfillment of degree requirements for the Doctor of Nursing Practice, Certified Registered Nurse Anesthetist track. Cesarean sections (CS) comprise 31% of all deliveries annually. Researchers suggest that the best method of anesthesia for this patient population is spinal anesthesia. However, spinal anesthesia, though advantageous for its reduced medication transfer across the placenta to the fetus and the pain management for the mother, comes with some adverse side effects. Hypotension, bradycardia, nausea, and vomiting are the key side effects of spinal anesthesia. Current literature suggests using prophylactic interventions to decrease the risk of hypotension and, thus, nausea and vomiting associated with spinal anesthesia.

Background

According to the Centers for Disease Control and Prevention, there were 1,148,692 CS deliveries in 2020 in the United States, which account for 31.8% of all births (Osterman, 2022). Mothers having an elective CS can request the type of anesthesia they would like, whether general anesthesia, spinal anesthesia, or combined spinal/epidural anesthesia, as long as the choice is safe for the mother and baby. The American Society of Anesthesiologists, 2022 suggests that a spinal or epidural anesthetic plan best suits CS deliveries. This is because a one-time spinal injection or an epidural catheter that remains in place and can be dosed with stronger medications for the delivery both reduce the amount of medication to the fetus and allow the mother to remain awake and participate in the delivery (American Society of Anesthesiologists, 2022).

Even though spinal anesthesia is the preferred anesthetic for patients undergoing a CS, it does not come without risks or side effects. The primary concern with spinal anesthesia in the parturient is hypotension, affecting up to 90% of parturients receiving spinal anesthesia. Hypotension not only affects the mother but can also cause harm to the fetus due to uterine blood flow lacking autoregulation and being dependent on maternal blood pressure. In addition, hypotension commonly leads to dizziness with nausea and vomiting in the mother. Hypotension in the mother, however, can cause far more life-threatening concerns for the fetus, such as bradycardia, acidosis, and the potential for cardiovascular collapse. Additional maternal side effects include bradycardia and shivering (Fitzgerald et al., 2019).

Researchers suggest that hypotension from spinal anesthesia is related to the Bezold-Jarisch reflex (BJR) (Arya et al., 2020). The inhibitory BJR happens when receptors in the epicardium of the left ventricle are stimulated by stretch, chemical substances, or medications (Arya et al., 2020). When enabled, the BJR increases parasympathetic activity, leading to hypotension, bradycardia, and vasodilation, and further inhibits sympathetic responses (Arya et al., 2020). The chemoreceptors and mechanoreceptors triggered during the BJR are sensitive to serotonin, also known as 5-HT3 (Arya et al., 2020). Ondansetron is a 5-HT3 receptor antagonist that blocks serotonin from initiating nerve signals on the chemoreceptors and mechanoreceptors, thus decreasing the response to the BJR (Aksoy et al., 2021). If the BJR can be blocked, the patient has a reduced risk of experiencing hypotension, bradycardia, nausea, and vomiting (Aksoy et al., 2021).

Problem Statement

With more than one million CS being performed every year, about 90% of mothers can be expected to experience hypotension from spinal anesthesia (Fitzgerald et al., 2019).

Researchers suggest the utilization of ondansetron prophylactically to help decrease hypotension before it occurs (Aksoy et al., 2021). Although there are guidelines from the American Association of Nurse Anesthesiology (AANA), 2022, for prophylactically giving ondansetron before spinal anesthesia, it is not always used. For example, 100% of providers at a rural hospital in northern Indiana have not adopted this practice. Therefore, the following PICO question was developed: Does an educational intervention change the current practice of anesthesia providers (at a rural hospital in northern Indiana) regarding the utilization of ondansetron prior to administering spinal anesthesia in parturients undergoing scheduled CS?

Gap Analysis

The investigator conducted an informal poll of anesthesia providers in the Summer of 2022 to evaluate the utilization of ondansetron in a rural anesthesia practice. The poll revealed that currently, ondansetron is not regularly administered prior to spinal anesthesia in laboring parturients. The anesthesia providers did not indicate awareness of this practice guideline. The practice of using ondansetron before spinal anesthesia is presently used by many certified registered nurse anesthetists (CRNAs) and is supported by the AANA with the most recent update to the obstetric guidelines in November of 2022 (American Association of Nurse Anesthesiology, 2022). The informal poll suggested a need for more knowledge surrounding the benefits of ondansetron and that an educational intervention could fill that knowledge gap.

Review of Literature

This literature review was conducted to evaluate articles discussing the use of ondansetron prior to spinal anesthesia in laboring parturients undergoing scheduled CS. The review search used the keywords *Zofran, ondansetron, spinal, spinal anesthesia, neuraxial anesthesia, cesarean section, cesarean delivery, Bezold-Jarisch,* and *sympathectomy.* This

literature review was conducted in October and November 2022 using PubMed and Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases through the EBSCO interface. The databases were searched using the following BOOLEAN phrases: Zofran AND spinal anesthesia, ondansetron AND spinal anesthesia, spinal anesthesia AND Bezold-Jarisch, ondansetron AND neuraxial anesthesia AND Bezold-Jarisch. The inclusion criteria were adults, CS surgery, parturients, spinal anesthesia, studies in English or translated to English, and studies done on humans. The literature review search initially resulted in 211 articles. After applying inclusion and exclusion criteria, the literature review search was reduced to 23 articles. After full-text scanning, ten articles were selected for inclusion in the literature review.

The literature review uncovered research studies that utilized different methods to evaluate the efficacy of ondansetron on spinal anesthesia-induced hypotension. The research focused on a few themes, such as the dose of ondansetron, the time of administration of the dose in relation to the placement of the spinal anesthesia, and the evaluation methods of efficacy.

Dose

Researchers have studied the best prophylactic dose of ondansetron to prevent hypotension. The recommended and studied doses ranged from four milligrams to eight milligrams. Of the 10 articles, four evaluated the use of four milligrams of ondansetron before the placement of spinal anesthesia (Shabana et al., 2018; Qian et al., 2020; Wahid et al., 2022; Xiao et al., 2020). Two of the 10 studies evaluated the use of eight milligrams of ondansetron (Aksoy et al., 2021; Karacaer et al., 2018). Three of the research studies compared the dose amounts of four, six, or eight milligrams of ondansetron to determine which dose would provide more benefit (Potdar et al., 2017; Samarah et al., 2020; Vashishth et al., 2022). Potdar et al. (2017) compared four milligrams of ondansetron to eight milligrams and determined that both

doses were beneficial in decreasing the severity of hypotension (P = 0.03); however, there was not a significant difference between the two doses. In sum, Xiao et al. (2020) and Shabana et al. (2018) indicate to give four milligrams of ondansetron. Furthermore, the AANA supports the indication of giving four milligrams of ondansetron before spinal anesthesia (American Association of Nurse Anesthesiology, 2022).

Timing

The appropriate timing of the dose of ondansetron with respect to the duration of effect of six hours varied among studies, and the dosing times ranged from five minutes to 20 minutes before the placement of spinal anesthesia. Five of the 10 articles gave ondansetron five minutes before administering spinal anesthesia (Aksoy et al., 2021; Karacaer et al., 2018; Potdar et al., 2017; Shabana et al., 2018; Vashishth et al., 2022). Three of the studies each gave ondansetron at varying times of 10 minutes (Xiao et al., 2020), 15 minutes (Wahid et al., 2022), and 20 minutes (Samarah et al., 2020). Qian et al. (2020) compared the administration of four milligrams of ondansetron five or 15 minutes before administering spinal anesthesia and found no significant statistical difference between the timing (P = 0.945). Based on the studies by Samarah et al. (2020), Wahid et al. (2022), and Xiao et al. (2022), it is efficacious to give ondansetron five to 20 minutes before administering spinal anesthesia. The current guidelines from the AANA do not indicate a dosing time in minutes but state that the dose should be administered before spinal anesthesia (American Association of Nurse Anesthesiology, 2022).

Efficacy Evaluation

There were two common benchmarks for the efficacy of giving ondansetron before spinal anesthesia in parturients to decrease hypotension. The two common assessment methods were monitoring for a decrease in the number of hypotensive or bradycardic episodes or assessing for

the quantity in milligrams or micrograms or the number of administrations of a vasopressor medication. Nine of the 10 studies utilized the amount of vasopressor used to treat hypotensive episodes to determine the efficacy of ondansetron in reducing hypotension from spinal anesthesia (Aksoy et al., 2021; Karacaer et al., 2018; Potdar et al., 2017; Qian et al., 2020; Samarah et al., 2020; Shabana et al., 2018; Vashishth et al., 2022; Wahid et al., 2022; Xiao et al., 2020). Additionally, three of the 10 research studies evaluated efficacy based on changes to the patient's blood pressure readings (Potdar et al., 2017; Shabana et al., 2018; Wahid et al., 2022).

Furthermore, Shabana et al. (2018) determined that giving a patient four milligrams of ondansetron before spinal anesthesia significantly decreased the degree of decline in the patient's mean arterial pressure readings immediately following the spinal anesthesia placement. For example, the study group that received ondansetron had a mean arterial pressure of 76.4, and the control group had a mean arterial pressure of 68.4 ($P = 0.007$) (Shabana et al., 2018).

Literature Review Conclusion

The administration of ondansetron before spinal anesthesia in parturient patients scheduled for a CS is efficacious in decreasing the severity of hypotension and bradycardia and, thus, nausea and vomiting. Decreasing the severity of hypotension in the mother can promote possible better outcomes for the fetus. The most recent update to the AANA obstetrical care guidelines supports the administration of ondansetron prior to spinal anesthesia. The guideline states that four milligrams of ondansetron should be administered prior to the placement of spinal anesthesia in parturients but does not specify a timeframe for administration (American Association of Nurse Anesthesiology, 2022).

Theoretical Framework

The theoretical framework that was utilized for this project was Lewin's Theory of Change. The three main components of Lewin's Theory of Change are unfreezing, change, and refreezing. Unfreezing takes place when people let go of an old practice. The component of change takes place when people can transform the way they think, feel, and act. Lastly, refreezing occurs when a person views the change as a new habit or standard of care (*Lewin's Change Theory – Nursing Theory,* 2020). For example, ondansetron is currently administered after the placement of spinal anesthesia at a rural hospital in northern Indiana. This project aimed to educate anesthesia providers on the benefits of administering ondansetron before spinal anesthesia. With the use of Lewin's Theory of Change, hopefully, anesthesia providers will unfreeze, change, and refreeze their practice of administering ondansetron after spinal anesthesia to before spinal anesthesia after learning the evidence-based practice benefits of ondansetron.

Project Aims and Objectives

This quality improvement project aimed to increase the knowledge of anesthesia providers (at a rural hospital in northern Indiana) on the benefits of using ondansetron prior to spinal anesthesia in parturient patients scheduled for a CS to help reduce hypotension. In the case of a parturient, hypotension not only affects the mother but can affect the fetus also. Blood flow to the fetus is not autoregulated and is directly related to the mother's blood pressure; therefore, if the mother is hypotensive, this decreases the blood flow to the fetus, which could lead to fetal complications (Elisha & Terry, 2018). The objectives were as follows:

-Include anesthesiologist physicians and CRNAs.

-Provide an in-person pre-test to evaluate knowledge of current evidence-based practice regarding ondansetron.

- Provide an in-person educational intervention following the pre-test.

-Provide a post-test in person following the educational intervention to assess knowledge gained from educational intervention and willingness to change practice.

-Perform a retrospective chart review from three months prior to educational intervention to determine when ondansetron was administered.

-Perform a retrospective chart review to determine when ondansetron was administered for three months following the educational intervention to determine if a practice change was made.

Project Design/Methods

This evidence-based practice quality improvement project was implemented utilizing an educational intervention to increase anesthesia provider's awareness of the benefits of ondansetron when performing spinal anesthesia.

First, a retrospective chart review of the previous three months was completed on all patients undergoing a scheduled CS with spinal anesthesia to evaluate if ondansetron was administered and, if so, if it was given before or after spinal anesthesia placement.

Next, one-on-one in-person meetings were held throughout the day when each anesthesia provider was available before or between operating room cases. In the first five minutes of the educational presentation, an in-person pre-test using Qualtrics was administered to all anesthesia-providing personnel at the facility, including CRNA staff and anesthesiologists. The pre-test included knowledge questions about ondansetron, the preferred method of anesthesia for a scheduled CS, whether ondansetron is administered, the timing of ondansetron, and the known benefits of the medication.

Following the pre-test, a PowerPoint presentation was delivered in person utilizing information from evidence-based research. Following the educational intervention, an in-person

post-test was administered, which included knowledge-based questions to gauge learning of educational material. The pre-test and post-test were administered via Qualtrics. To ensure participants' anonymity, they were asked to create a four-digit code to provide on the Qualtrics surveys that could not be used to identify them. Participation was voluntary, and the participant's pre-test and post-test performance remained anonymous. Participants were not rewarded or compensated for participating in the project.

Lastly, a chart review of the three months following the educational intervention was completed to evaluate if the anesthesia providers changed their practice to administer ondansetron before spinal anesthesia for parturients undergoing a scheduled CS.

Project Site and Population

The project was implemented at a small rural hospital in northern Indiana. The hospital has four operating rooms. On average, the anesthesia providers perform anesthesia for 20 cesarean deliveries per month. The participants were recruited as a convenience sample of four anesthesiologists and one CRNA who jointly have many years of experience.

Measurement Instruments

Participants were administered a multiple-choice and fill-in-the-blank pre-test and post-test. The validity of the knowledge-based questions was confirmed by two community CRNA experts in obstetrical anesthesia. All information collected for this project was obtained from participants' pre-tests and post-tests. Please see Appendix B and Appendix C for copies of the pre-test and post-test. In addition, a retrospective chart review was completed and only looked at charts of patients who received spinal anesthesia for a scheduled CS and excluded patients undergoing an emergent CS. No identifying patient information was collected. A tool was developed to summarize the data into quantitative data for statistical analysis. This tool was

developed to compare the timing of ondansetron administration before and after the educational intervention. Please see Appendix F for a copy of the data collection tool.

Data Collection Procedures

Once approval was obtained from Ascension Hospital and Marian University Institutional Review Boards during the Fall semester of 2023, data collection was started. Participants were provided with an in-person pre-test, educational intervention, and post-test on a voluntary and anonymous basis. A chart review was completed for the three months before the educational intervention. Then, three months after the educational intervention, a chart review was completed during the Spring semester of 2024. Qualtrics was used to administer the pre-test and post-test and to help provide data analysis. Data was entered into Excel, and IBM software, SPSS, was used to perform statistical analysis of the data.

Ethical Considerations/Protection of Human Subjects

This DNP project was submitted to the Marian University Institutional Review Board as a practice change project. The DNP project was also submitted to Ascension Hospital's Institutional Review Board for approval. The DNP student did not collect demographic information from the participants (anesthesia providers), nor was patient information collected. All data from patient charts regarding ondansetron use was collected as binary, indicating before or after spinal anesthesia administration. No patient demographics, such as name, ethnicity, age, or weeks of gestation, were collected. Anesthesia participants were assured anonymity by choosing a random four-digit code on the day of education implementation. All participant data will be stored on the DNP student's laptop for two years following the project and will be password-protected to prevent access by unauthorized users. No patient data was obtained or stored.

Results

Five full-time employed anesthesia providers were eligible and participated in the project. The sample was a convenience sample. All five participants completed the pre-test, participated in the one-on-one educational PowerPoint, and then completed the post-test.

Participants

The only data collected on the participants was their years of practice in anesthesia. As the chart below shows, the providers have many years of experience. One provider, making up 20% of the group, has been in anesthesia for zero to five years. Two of the five providers had six to 10 years of experience, making up 40% of the population. Zero providers fell in the 11 to 19 years category. Lastly, making up 40% of the population, two of the five providers had 20 years or more of anesthesia experience.

Years Practicing Anesthesia

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5	1	20.0	20.0	20.0
	6-10	2	40.0	40.0	60.0
	11-19	0	0	0	0
	20+	2	40.0	40.0	40.0
	Total	5	100.0	100.0	100.0

Pre-test

The pre-test consisted of 10 questions. One demographic question asked about years of anesthesia experience, four background information questions, and five knowledge assessment questions. The questions included selecting one, selecting two, selecting multiple, and filling in the blank.

To gauge the prevalence of a spinal anesthesia plan for scheduled CS, the question was asked, “What is the primary anesthesia plan for scheduled CS patients at your facility?” The response was that 100% of providers answered “spinal anesthesia.”

Next, the providers were asked how often they experienced hemodynamic changes following spinal anesthesia. The responses were almost always (2 providers, 40%), Often (2 providers, 40%), Sometimes (1 provider, 20%), and Never (0%). This data helps to solidify the severity of the problem of hemodynamic changes following spinal anesthesia.

Providers were then asked if they administered ondansetron when performing spinal anesthesia, and 100% of providers responded yes. They were also asked how many minutes before or after spinal anesthesia they administered ondansetron. The responses were zero to five minutes (0%), five to 10 minutes (0%), 10 to 15 minutes (1 provider, 20%), 15 to 20 minutes (1 provider, 20%), and 20 or more minutes (3 providers, 60%).

Knowledge Assessment

A knowledge assessment was completed comparing pre-test and post-test scores to assess the educational intervention's success. The same five questions were asked on both tests. Please see Appendix F for a comparison of responses. The tests were graded all or nothing regarding points for correct responses, with five points being the maximum points possible. The pre-test scores ranged from one to two out of five. Descriptive statistics were computed, and the pre-test had a mean of 1.60 with a standard deviation of 0.548. The post-test scores were much improved, and all participants scored a five out of five with a mean of five and a standard deviation of 0.000. A paired t-test was then performed using SPSS software, comparing the pre-test mean to the post-test mean, and determined that the results were significant ($p < 0.001$).

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre-test Score	1.60	5	.548	.245
	Post-test Score	5.00	5	.000	.000

Paired Samples Test

		Paired Differences					t	df	Significance One-Sided p	Significance Two-Sided p
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper				
Pair 1	Pre-test Score Post-test Score	-3.400	.548	.245	-4.080	-2.720	-13.880	4	<.001	<.001

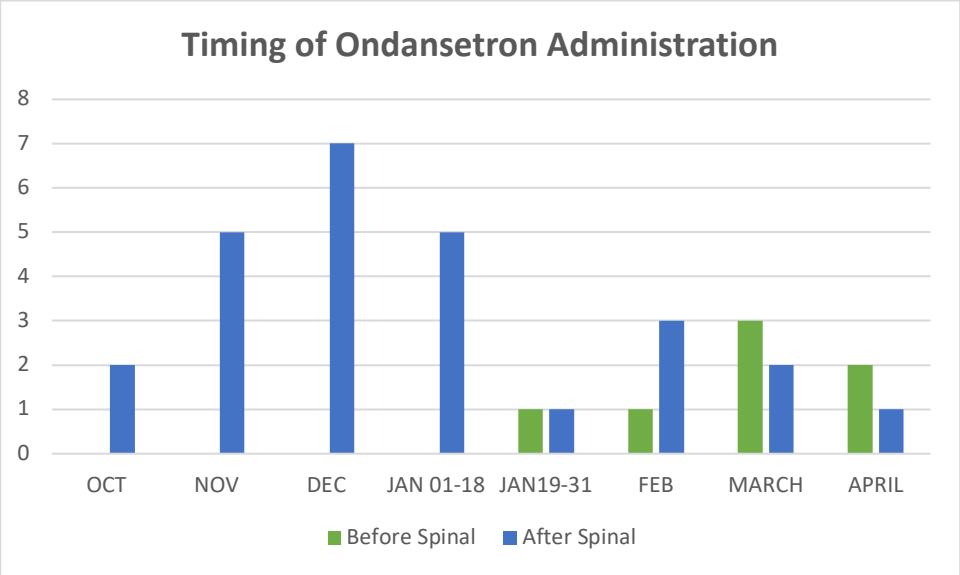
Willingness to Change

Lastly, there was one question on the post-test that was not a knowledge assessment but rather an assessment of willingness to change. The question asked, “When providing spinal anesthesia for scheduled CS patients, do you plan to administer a 5-HT3 antagonist before placing spinal anesthesia?” All five providers (100%) responded that “Yes” they plan to administer ondansetron before spinal. This response shows a willingness to change their practice from administering ondansetron after spinal anesthesia to administering it before based on information received from the educational interventions.

Chart Review

A retrospective chart review was completed to assess anesthesia providers' timing of administering ondansetron in relation to spinal anesthesia in parturient patients receiving a scheduled CS. Please see Appendix G for the data collection tool used to compare the administration of ondansetron before and after the educational intervention. Data was collected

for three months before the educational intervention, which took place on January 18th, 2023. During those three months, 37 CS were performed; however, due to inclusion criteria, only 19 cases were included in this project. For the 19 cases included before the educational interventions, ondansetron was given 0% of the time before spinal anesthesia. In the three months following the educational intervention, 31 CS were performed, but only 14 of those met the inclusion criteria. Of the 14 cases included, ondansetron was given seven times before spinal anesthesia and seven times after spinal anesthesia, resulting in a 50% increase in practice change to administer before spinal anesthesia.



Discussion

The results from the knowledge assessment demonstrated that the providers gained critical knowledge on the value of using ondansetron. Additionally, when asked, 100% of providers answered yes that they plan to change their practice to administering ondansetron before spinal placement. The retrospective chart review showed an improvement from ondansetron never being given before spinal anesthesia to being given before in 50% of cases.

Recommendations

Based on the results from the retrospective chart review, which indicated that only 50% of the time, providers changed their practice to reflect current guidelines, a recommendation is to continue education and implement a protocol.

Limitations

One limitation of this project was the small sample size of five anesthesia providers. However, all providers at the facility, including anesthesiologists and a CRNA, participated in all aspects of the project. Additionally, a t-test was performed to help account for the smaller sample size.

A critical aspect of the project was the inclusion criteria. For instance, cases were omitted where the surgeon requested an epidural placement for a scheduled cesarean section instead of a spinal due to the anticipated length of the surgery. These cases, while significant, did not meet the specific criteria for the project. There are only two obstetricians performing CSs at this hospital, so this largely decreased the number of cases included in the project.

Lastly, during the six months of data collection, the anesthesia department employed multiple traveling anesthesiologists to help cover staffing shortages. The traveling anesthesiologists did not receive the educational intervention. Therefore, the CSs performed by these anesthesiologists were omitted from the data collection, further decreasing the number of cases available for data analysis.

Conclusion

Hypotension from spinal anesthesia in the parturient patient can cause a cascade of negative outcomes. Administering ondansetron before placing spinal anesthesia can help mitigate some of the negative outcomes. This DNP project sought to determine whether

educating anesthesia providers on the benefits of ondansetron prior to placing spinal anesthesia would change the current practice of giving it after the procedure.

This project's educational intervention was successful in increasing anesthesia providers' knowledge of the benefits of ondansetron prior to spinal anesthesia in parturients undergoing scheduled CS. When polled, providers were willing to change their practice, and the retrospective chart review indicated that providers were working to make a change with a 50% increase in ondansetron administration before spinal anesthesia. Practice change takes time, and with a willingness to change, a complete practice change is possible.

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Appendix A

Literature Matrix

Citation	Research Design	Purpose / Aim	Population / Sample size n=x	Major Variables	Instruments / Data collection	Results
Aksoy et al. (2021)	Double-blinded, randomized placebo-controlled trial	To compare 8mg of Zofran to 3mg of Granisetran to a control of normal saline to determine if a 5-HT3 antagonist will help decrease hypotension from spinal anesthesia in parturients	Group I – 8mg Zofran (n=40) Group II – 3mg Granisetron (n=40) Group III – 10ml normal saline (n=40) N=140	8mg of Zofran vs. 3mg of Granisetron vs. 10ml normal saline 5 minutes prior to spinal	Number of doses of 6mg of ephedrine used for hypotension (30% decrease in SBP)	Group I - 20 patients (50%), Group II – 12 patients (30%), Group III – 29 patients (72.5%) required ephedrine for hypotension (P = 0.001). Group III significantly higher than Group I (P = 0.033) and Group II (P <0.001). Group I ephedrine use compared to Group II was not statically significant (P = 0.055).
Heesen et al. (2016)	Systematic review, meta-analysis	To determine if a 5-HT3 antagonists decreases hypotension with spinal anesthesia	17 clinical trials (8 OB, 9 non-OB) N =1604	Zofran doses ranging from 2 to 12mg, Granisetron,	Vital signs, hypotension definition varied by research trial, vasopressor use	A 5-HT3 antagonist prevented hypotension in obstetric and non-obstetric cases (p=0.003). Statistical significance for obstetric cases alone (p=0.1).
Karacaer et al. (2017)	Prospective, randomized, double-blinded control study	To determine if Zofran decreased the incidence of hypotension, use of norepinephrine, and adverse effects of spinal anesthesia	Group O – 8mg Zofran (n=54) Group S - 4ml normal saline (n=54) N=108	8mg of Zofran vs. 4ml of normal saline 5 minutes prior to spinal anesthesia	Incidence of hypotension, number of hypotensive episodes, total amount of norepinephrine uses, adverse effects that took place	There was no significant difference in the incidence of hypotensive episode between Group O and Group S (p = 0.767). Number of hypotensive episodes greater for Group S than Group O and statistically significant (p = 0.009). Amount of norepinephrine used greater for Group S than Group O and was statistically significant (p= 0.009).

Potdar et al. (2017)	Prospective, randomized, double-blinded placebo study	To compare different doses of Zofran to 10ml of normal saline given prior to spinal anesthesia in parturients to compare vasopressor needs and incidence of nausea and vomiting	Group C – 10ml normal saline (n=60) Group F – 4mg Zofran (n=60) Group E – 8mg Zofran (n=60) N=180	10ml of normal saline vs. 4mg of Zofran vs. 8mg of Zofran 5 minutes prior to spinal anesthesia	Incidence of hypotension, vasopressor requirements, incidence of nausea and vomiting	Incidence of hypotension was less in Group F and Group E than Group C (p = 0.03). Ephedrine need for hypotension (SBP <90) was significantly higher in Group C compared to Group E and Group F (p= 0.03) No statical significance between Group E and Group F.
Qian et al. (2020)	Prospective randomized double-blinded study	To determine if the time the Zofran is administered before spinal anesthesia (SA) in parturients effects the amount of phenylephrine dose required	Group A – 4mg Zofran – 5 minutes (n=25) Group B – 4mg Zofran – 15 minutes (n=25) Group C – normal saline – 15 minutes (n=25) N=75	4mg of Zofran 5 minutes before SA vs. 4mg of Zofran 15 minutes before SA vs normal saline 15 minutes before SA	Up-down drip allocation for phenylephrine, Effective dose(ED50) = no hypotension from time of SA to delivery of neonate	Less hypotension in Group A and Group B compared to Group C (p <0.05). ED 50 Group A = 0.33mcg/kg/min, ED50 Group B = 0.36 mcg/kg/min, ED50 Group C = 0.41mcg/kg/min. This data indicates there is no benefit to giving Zofran earlier but there is benefit to giving it over normal saline.
Samarah et al. (2020)	Prospective, randomized, double-blinded clinical trail	To determine if the amount of Zofran given before spinal anesthesia in parturients decreased hypotension	Group O4 – 4mg Zofran (n=51) Group O6 – 6mg Zofran (n=51) Group C – normal saline (n=50) (N=151)	Zofran 4mg vs. 6mg vs. normal saline (control group) administered 15 to 20 minutes prior to spinal	Amount of ephedrine in mg used to treat hypotension, episodes of hypotension	Significantly more patients in Group C required higher doses of ephedrine compared to Group O4 and Group O6 (p= <0.001). The number of hypotensive episodes was not significant between the three groups (p=0.07). *Do not show a decrease in the number of hypotensive episodes between the groups but did show that Zofran decreased the severity of hypotension thus decreasing the amount ephedrine given.

Shabana et al. (2018)	Prospective double-blinded randomized control study	To evaluate the efficacy of Zofran given before SA in parturients at decreasing hypotension, N/V, and bradycardia.	Group I – 4mg Zofran (n=50) Group II – normal saline (n=50) N=100	4 mg Zofran vs. normal saline both given 5 minutes before SA	Vital signs, episodes N/V, vasopressor requirements	Group I required a significantly lower amounts of vasopressors (p=0.005). Bradycardia episodes were significantly lower in Group I than Group II (p=0.02). Drops in MAP were significantly lower in Group I than Group II (p=0.007).
Vashishth et al. (2022)	Prospective, randomized, double-blinded control study	To determine the effectiveness of different doses of Zofran on hemodynamics in parturients receiving SA	Group O4 – 4mg Zofran (n=60) Group O6 – 6mg Zofran (n=60) Group O8 – 8mg Zofran (n=60) Group S – normal saline (n=60) N=240	4mg Zofran vs. 6mg Zofran vs. 8mg Zofran vs. normal saline all given 5 minutes before SA	Vital signs, hypotension = drop in SBP more than 20% from baseline, N/V episodes, ephedrine requirements	There was a significant decrease in hypotensive episodes amongst all Zofran groups ($p<0.0001$). Ephedrine requirements were significantly lower in all Zofran groups compared to normal saline ($p<0.0001$). 6mg and 8mg were more effective than 4mg at preventing drops in MAP.
Wahid et al. (2022)	Prospective, randomized, study	To compare Zofran to Granisetron at preventing hemodynamic instability in parturients receiving SA	Group N - Placebo (n=40) Group O – 4mg Zofran (n=40) Group G – 3mg Granisetron (n=40) N=120	4mg Zofran vs. 3mg Granisetron given 15 minutes before SA	Vital signs, hypotension = SBP drop more than 20% below baseline, bradycardia = HR more than 20% below baseline, phenylephrine doses	Group O and Group G both had statistically significant lower incidence of hypotension compared to Group N. Group O = ($p=0.020$) Group G = ($p<0.001$). Group O and Group G both had statistically significant decreased doses of phenylephrine compared to Group N. Group O = ($p<0.001$) Group G = ($p<0.001$).
Xiao et al. (2019)	Parallel-group, randomized, double-blinded study	To determine the ED50 dose of prophylactic phenylephrine in parturients receiving SA when given 4mg of Zofran	Group O – 4mg Zofran (n=30) Group C – normal saline (n=30) N=60	4mg Zofran vs. normal saline 10 minutes prior to spinal	Up-down sequential analysis for phenylephrine, vital signs, hypotension = SBP decrease to <80% of baseline, ED50 = no hypotensive	ED50 was lower in Group O compared to Group C. Group O 0.24mcg/kg/min compared to Group C 0.32mcg/kg/min. Statistically significant ($p<0.001$) *Administration of Zofran is associated with a 26% reduction to the ED50 of phenylephrine drip infusion.

		compared to normal saline			occurrence from time of starting drip to delivery of infant	

Appendix B

Pre-test Questionnaire

1. How many years have you been practicing anesthesia?
   a. SRNA
   b. 1-5
   c. 6-10
   d. 11-15
   e. 16-20
   f. 20 +

2. What is the primary anesthetic plan for scheduled C-section patients at your facility?
   a. General anesthesia
   b. Spinal anesthesia
   c. Epidural anesthesia
   d. Combined spinal/epidural

3. How often do you observe hemodynamic changes in your patient following spinal anesthesia?
   a. Almost always
   b. Often
   c. Sometimes
   d. Never

4. Which reflex is responsible for the hemodynamic changes following spinal anesthesia in parturients undergoing c-sections? (Fill in the blank)

5. Which TWO hemodynamic changes are most common following spinal anesthesia? (Select 2)
   a. Tachycardia
   b. Bradycardia
   c. Hypertension
   d. Hypotension

6. What is the most common indicator of hypotension following spinal anesthesia in the parturient?
   a. Shortness of breath
   b. Nausea and vomiting
   c. Headache
   d. Drowsiness

7. When providing spinal anesthesia for C-section patients, do you administer a 5-HT3 antagonist such as Zofran?
   a. Yes
   b. No

8. If yes, when is the best time to administer a 5-HT3 antagonist?
    a. Before spinal anesthesia administration
    b. After spinal anesthesia administration

9. How many minutes before or after spinal anesthesia administration do you typically give the 5-HT3 antagonist?
    a. 0-5 mins
    b. 5-10 mins
    c. 10-15 mins
    d. 15 – 20 mins
    e. 20 plus mins

10. What benefits does the administration of Zofran provide to the parturient undergoing spinal anesthesia? (Select all that apply)
    a. Decreased nausea
    b. Decreased vomiting
    c. Decreased pain
    d. Decreased degree of hypotension
    e. Decreased severity of bradycardia

Appendix C

Post-test Questionnaire

1. Which reflex is responsible for the hemodynamic changes following spinal anesthesia in parturients undergoing c-sections? (Fill in the blank)

2. Which TWO hemodynamic changes are most common following spinal anesthesia? (Select 2)
   a. Tachycardia
   b. Bradycardia
   c. Hypertension
   d. Hypotension

3. What is the most common indicator of impending hypotension in the parturient following spinal anesthesia?
   a. Shortness of breath
   b. Nausea with or without vomiting
   c. Headache
   d. Drowsiness

4. When providing spinal anesthesia for scheduled C-section patients, do you plan to administer a 5-HT3 antagonist before placing spinal anesthesia?
   a. Yes
   b. No

5. When is the best time to administer a 5-HT3 antagonist?
   a. Before spinal anesthesia administration
   b. After spinal anesthesia administration

6. What benefits does the administration of Zofran provide to the parturient undergoing spinal anesthesia? (Select all that apply)
   a. Decreased nausea
   b. Decreased vomiting
   c. Decreased pain
   d. Decreased degree of hypotension
   e. Decreased severity of bradycardia

Appendix D

Ascension Health IRB Approval

INSTITUTIONAL REVIEW BOARD
NOT HUMAN SUBJECTS RESEARCH

To: PANCHAPAKESAN HARAN

cc: Katharine Holmer

From: Ascension Health Institutional Review Board

Date: October 6, 2023

On 10/6/2023, the IRB reviewed the following submission and determined that the proposed activity is not research involving human subjects as defined by DHHS/FDA regulations.

Type of Review:	Initial Study
Title:	Ondansetron Prior to Subarachnoid Anesthesia in Parturient Patients Undergoing Cesarean Section to Decrease Hypotension: A Practice Change Guideline
Investigator:	PANCHAPAKESAN HARAN
IRB Study ID:	RIN20230097
Funding:	Name: 01Unfunded
Documents Reviewed:	See list at close of letter below signature line

IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these activities are research involving humans in which the organization is engaged, please submit a new request to the IRB for a determination. You can create a modification by clicking **Create Modification / CR** within the study workspace in the Ascension eIRB system.

Documents Reviewed for this Submission:
• Ascension QA-QI worksheet _Holmer.docx, Category: Other;

• Data points .docx, Category: Other;

• DNP consent .docx, Category: Recruitment Materials;

Appendix D

Ascension Health IRB Approval

• DNP IRB protocol.docx, Category: IRB Protocol;

• DNP ppt_Holmer.pptx, Category: Other;

• DNP Pre_Post Survey.docx, Category: Study Tools (Data Collection Sheet, Surveys, etc.);

Appendix E

Marian University IRB approval

MARIAN UNIVERSITY
Indianapolis ®

Institutional Review Board

DATE:	11/28/2023
TO:	Katherine Holmer & Lee Ranalli
FROM:	Institutional Review Board
RE:	S23.205
TITLE:	Ondansetron prior to subarachnoid anesthesia in parturient patients undergoing cesarean section to decrease hypotension: A practice change
SUBMISSION TYPE:	New Project
ACTION:	Determination of Initial Review: Defer to Other Institution's IRB
DECISION DATE:	11/21/2023

The Institutional Review Board at Marian University has reviewed your protocol and the supporting documents you submitted from the research partner site IRB. We defer to the decision reached by the partner IRB following review. As such, there will be no further review of your protocol by the Marian University IRB. Please inform us of any methodological changes, adverse outcomes experienced by participants, or changes in the approval granted by the partner site's IRB. The IRB also reminds the PIs to be mindful of all HIPPA guidelines when disseminating findings.

Christina Pepin, Ph.D., RN, CNE
Chair, Marian University Institutional Review Board

Appendix F

Pre-test Post-test Data Comparison

QUESTION	ANSWERS	n (Pre-Test)	% Correct Responses	n (Post-test)	% Correct Responses
Which reflex is responsible for hemodynamic changes following Spinal Anesthesia? (Fill in the Blank)	Cardiac Accelerators Bainbridge Sympathetic Bezold-Jarisch	3 1 1 0	0%	0 0 0 5	100%
Two Most Common Hemodynamic Changes Following Spinal Anesthesia?	Tachycardia Bradycardia Hypertension Hypotension	0 5 0 5	100%	0 5 0 5	100%
Most Common Indicator of Hypotension?	SOB N/V Headache Drowsiness	0 3 1 1	60%	0 5 0 0	100%
When Is the Best Time to Administer 5-HT3 Antagonist?	Before Spinal After Spinal	0 5	0%	5 0	100%
Benefits of Administration of Zofran (Select All that Apply)	Decreased Nausea Decreased Vomiting Decreased Pain Decreased HypoT Decreased Brady	5 3 1 0 0	0%	5 5 0 5 5	100%

Appendix G

Data Collection Tool

Number of Cases Oct 18th-31st - 3 cases
Number of Cases Nov 1st-30th – 11 cases
Number of Cases Dec 1st – 31st – 15 cases
Number of Cases Jan 1st – 18th – 8 cases
Educational Intervention
Number of Cases Jan 19th-31st – 3 cases
Number of Cases Feb 1st – 29th – 9 cases
Number of Cases March 1st -31st – 14 cases
Number of Cases April 1st – 15th – 5 cases
Number of Cases Jan 19th- Feb 23rd: 8

Number of Scheduled Cesarean Section Cases Included in the Study

	OCT	NOV	DEC	JAN 01-18	Jan 19-31	FEB	March	April 01-15
Spinal	II	IIIII	IIIIIII	IIIII	II	IIII	IIIII	III
Zofran Before					I	I	III	II
Zofran After	II	IIIII	IIIIIII	IIIII	I	III	II	I

Reasons a case was omitted from the study:

- One surgeon requests an epidural instead of a spinal due to the length of surgery. These cases were omitted because they did not meet the study's criteria.
- Emergent cases were omitted because they did not meet the study's criteria.
- Cases performed by traveling staff (not permanent) who did not receive educational intervention were omitted.