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## **Objective Structured Clinical Examination for Intraoperative Hypotension and Hypertension Management**

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OBJECTIVE STRUCTURED CLINICAL EXAMINATION FOR INTRAOPERATIVE  
HYPOTENSION AND HYPERTENSION MANAGEMENT

by

James David Ingram and Andrew McGinity

A Doctoral Project  
Submitted to the Graduate School,  
the College of Nursing and Health Professions  
and the School of Leadership and Advanced Nursing Practice  
at The University of Southern Mississippi  
in Partial Fulfillment of the Requirements  
for the Degree of Doctor of Nursing Practice

Approved by:  
Dr. Stephanie Parks, Committee Chair  
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## ABSTRACT

Managing intraoperative hypotension and hypertension is a non-technical skill anesthesia providers need to maintain patient safety. Upon transitioning from didactic training to clinical training, SRNAs may find it difficult to manage a patient's blood pressure intraoperatively. The ultimate consequence of the delayed or improper treatment of intraoperative blood pressure perturbations is end-organ damage at the patient's expense. Unintentionally causing a patient harm will lead to an SRNA losing confidence in their abilities. This OSCE is intended to increase SRNA confidence and competence regarding intraoperative hypotension and hypertension management before entering the clinical arena.

The hypotension and hypertension management tools and OSCE template were provided to second-year SRNAs, third-year SRNAs, and licensed CRNAs. After reviewing the information, fifty-six SRNAs and CRNAs participated in a survey regarding the effectiveness of the OSCE. At least 90% of survey participants strongly agreed on the instructions were clear and concise. Additionally, at least 90% of respondents are able to identify the causes of intraoperative blood pressure perturbations and can create a plan of care to treat hypotension and hypertension. After reviewing the survey results, the OSCE for Intraoperative Hypotension and Hypertension Management could improve first-year SRNA's competence and help prevent poor patient outcomes.

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## LIST OF ABBREVIATIONS

<i>AACN</i>	The American Association of Colleges of Nursing
<i>AANA</i>	The American Association of Nurse Anesthesiologists
<i>ANS</i>	Autonomic Nervous System
<i>CRNA</i>	Certified Registered Nurse Anesthetist
<i>DL</i>	Direct Laryngoscopy
<i>DNP</i>	Doctor of Nursing Practice
<i>ETT</i>	Endotracheal Tube
<i>IOM</i>	Institute of Medicine
<i>IRB</i>	Institutional Review Board
<i>MAP</i>	Mean Arterial Pressure
<i>NAP</i>	Nurse Anesthesia Program
<i>OSCE</i>	Objective Structured Clinical Examination
<i>SBP</i>	Systolic Blood Pressure
<i>SNS</i>	Sympathetic Nervous System
<i>SRNA</i>	Student Registered Nurse Anesthetist
<i>USM</i>	The University of Southern Mississippi

## CHAPTER I – INTRODUCTION

Kohn et al. (2000) led the charge on improving patient safety through the Institute of Medicine's (IOM) groundbreaking report, *To Err is Human: Building a Safer Health System*. Since then, simulation has become widely accepted as an effective educational modality to increase patient safety. Student Registered Nurse Anesthetists (SRNA) begin developing technical and non-technical skills through simulation. Without formalized training on intraoperative blood pressure control, SRNAs are likely to make judgment errors, ultimately compromising patient safety. With structured simulation, the risk of patient harm is mitigated and students develop decision-making skills.

### Background of the Problem

An investigation of preventable closed claims in the American Association of Nurse Anesthetists (AANA) database revealed that 65% of the claims resulted from errors in judgment (Kremer et al., 2019). SRNAs lack non-technical skills, increasing the likelihood of errors in judgment. Traditionally, simulation has improved familiarity with equipment and technical procedures (Wunder, 2016). Incorporating critical events into simulation scenarios promotes the early development of non-technical skills while maintaining patient safety.

Objective Structured Clinical Examinations (OSCE), unlike traditional modes of testing, allow instructors to assess knowledge and clinical skills simultaneously. A simulation situation developed with the OSCE framework will enable SRNAs to apply didactic knowledge to a clinical scenario. Intraoperative blood pressure management can be a daunting task, especially for a novice. The hemodynamic effects of anesthetic drugs and interventions are well-documented throughout the literature. This OSCE applies

Miller's Pyramid of Assessment (Miller, 1990) to safely expose SRNAs to intraoperative blood pressure management.

#### Statement of the Problem

Simulation-based education is a safe training modality that encourages SRNAs to apply didactic knowledge in high-risk situations. Simulation aids in the development of non-technical skills and decision-making (Wunder, 2016). New SRNAs lack the non-technical skills necessary for managing intraoperative hypertension and hypotension. Consequently, patient safety is compromised, leading to increased postoperative morbidity and mortality. This doctoral project aimed to create an OSCE for intraoperative blood pressure management to train and evaluate SRNAs at The University of Southern Mississippi (USM).

#### Significance of the Problem

Anesthesia providers must be adept at controlling intraoperative blood pressure. Hemodynamic fluctuations are common in anesthetized patients due to the effects of patient positioning, anesthetic drugs, and surgical stimulation. Blood pressure outside of an acceptable range without prompt treatment is detrimental to the surgical patient. While the exact intraoperative blood pressure target remains unclear, hypotension is associated with postoperative organ injury (London, 2021). Conversely, there is a weak association between intraoperative hypertension and adverse outcomes (Sessler et al., 2019), but it requires equal attention.

Simulation education allows SRNAs to develop non-technical skills before working with patients in the clinical setting. "Repeated exposure to non-technical skills from the first to second exposure and the first to third exposure showed significant

improvement in non-technical skills” (Wunder, 2016, p. 50). While SRNAs have critical care experience, intraoperative blood pressure management is challenging, especially without formal training. This OSCE will help SRNAs become aware of the situations surrounding blood pressure fluctuations during surgery.

#### Available Knowledge

A traditional clinical examination is made up of a single case. Students have 45 minutes to assess patient history, perform physical examinations, formulate diagnoses and differentials, and gather data concerning patient management during the experience. The test evaluates the student’s ability to make appropriate clinical judgments (Ballister, 2018).

#### *OSCE Defined*

An OSCE strategically includes different curriculum areas and challenges various skills (Ballister, 2018). The OSCE reaches beyond traditional testing methods by objectively assessing the knowledge base and clinical application simultaneously. The academic portions include answering questions asked by an examiner based on the materials provided in the curriculum.

#### *OSCE Structure*

The structure is a unique design because it maintains objectivity, unlike any other examination. However, adequate preparation by the examiner and examinee is required. Items used to test candidates are catered explicitly toward evaluating the extent to which the SRNA completes each task. The candidates’ feelings must be suppressed during testing to inhibit any form of subjectivity. Thus, the patient/client’s emotions take

precedence in this type of examination, distinguishing it from the traditional clinical model.

Students are asked to rotate through individual workstations in 5–10-minute intervals performing each task. An objective examiner evaluates each student based on specific criteria outlined by each OSCE. Patients may be live actors or electronically simulated. Unlike previous methods, every station has a different examiner (Parks, 2007). Simulation is essential to the OSCE structure by providing professionals, examiners, and trainees an opportunity to expand their expertise and knowledge.

#### *Current Role of OSCE in Advanced Practice Registered Nursing*

OSCEs play a significant role in advanced practice philosophy. For example, the OSCE is structured toward obtaining objectivity. Every candidate is assessed under the same circumstances even when live model patients are entered into the examination room. An OSCE candidate is evaluated for each step that they can accurately perform. This criterion allows for creating objectivity in performance for the advanced practice nurse. As such, the assessment of clinical skills is from the perspective of putting the patient/client first. Therefore, it is far less subjective.

Further, structured stations in OSCEs require minimum tasks when simulated patients are utilized. A key role is perceived when detailed scripts are offered to mandate that data is accumulated in the same by all candidates. Scripts are deliberately advanced to include the patient's emotions during the consultation (Aronowitz et al., 2017).

#### *Anatomy and Physiology of Autonomic Nervous System*

The autonomic nervous system (ANS) plays a significant role in controlling the circulation. The sympathetic division of the ANS has more influence on circulation than



its counterpart, the parasympathetic division. Vasoconstrictor fibers from the sympathetic nervous system (SNS) are present in nearly all segments of the circulation. The vasomotor center, located in the pons and medulla, sends sympathetic signals to arteries and veins via vasoconstrictor fibers, ultimately resulting in vasoconstriction.

Sympathetic signals are simultaneously transmitted to blood vessels and the adrenal medulla. Stimulation of the adrenal medulla results in the release of epinephrine and norepinephrine (Barash et al., 2017). These endogenous catecholamines interact with receptors on blood vessels, causing vasoconstriction in most instances. On the contrary, decreased sympathetic stimulation reduces circulating catecholamines to promote vasodilation (Barash et al., 2017). The function of the SNS is vital in relation to blood pressure and the circulatory system.

### *Sympathetic Tone*

The vasomotor center continuously stimulates vasoconstrictor fibers under normal circumstances. The constant stimulation creates a state of tonicity. In the tonic state, blood vessels are partially constricted. Because of sympathetic tone, the SNS can enact change through vasodilation or constriction (Barash et al., 2017). Without sympathetic tone, blood vessels would be maximally dilated and only affect blood pressure through vasoconstriction.

### *Reflex Mechanisms*

The nervous system's control of blood pressure is rapid but temporary. The baroreceptor reflex is an important aspect in the short-term management of blood pressure. Baroreceptors, also known as stretch or pressure receptors, reside in arterial

walls. They respond to changes in the tension of the vessel walls. Arteries containing an abundance of baroreceptors include carotid arteries and the aortic arch.

When stimulated, baroreceptors send information to the medulla, which signals vessels to dilate or constrict (Barash et al., 2017). When blood pressure is increased (baroreceptor is stretched), information from baroreceptors causes a decrease in heart rate and blood pressure through a slight inhibition of the SNS. Conversely, in periods of hypotension, the information received from baroreceptors elicits increased SNS firing to increase blood pressure.

### *Pharmacology*

To be an expert anesthesia provider, it is necessary to have a thorough understanding of pharmacology. Many of the anesthetic agents directly or indirectly affect blood pressure. Knowing the effects of medications on a patient's blood pressure will aid the anesthesia provider in creating a treatment plan for blood pressure fluctuations. The following sections describe the blood pressure effects of commonly used drugs in anesthesia.

### *Anesthetic Drugs*

The drugs administered by anesthesia providers provide optimal surgical conditions for the surgeon and patient. Most intravenous and inhalation drugs given to sedate patients perioperatively cause hypotension. Desflurane, isoflurane, and sevoflurane are commonly used volatile anesthetic agents during general anesthesia induction or maintenance. Potency differs among these inhalation agents, but they all produce a dose-dependent decrease in blood pressure (Flood et al., 2015). The

pharmacodynamic effects of inhalation anesthetics result in decreased sympathetic tone of blood vessels. The result is vasodilation and hypotension.

Propofol is a sedative-hypnotic drug used for the induction of anesthesia.

Benzodiazepines, specifically midazolam, are given perioperatively to decrease anxiety.

Propofol and midazolam are in separate drug classes, but they both potentiate the chief inhibitory neurotransmitter of the central nervous system (Flood et al., 2015). Along with volatile anesthetics, propofol and versed can cause hypotension.

### *Vasodilators*

Vasodilators work by causing direct relaxation of vascular smooth muscle, resulting in blood pressure decrease due to blood vessel dilation. Vasodilation is caused by various mechanisms that are not entirely understood but are likely to incorporate potassium channels opening stimulation of nitric oxide production via the vascular endothelium (London, 2021). In contrast to other medicines, such as calcium channel blockers, which similarly cause dilation of blood vessels, vasodilators function directly on the smooth muscle walls.

### *Beta-Blockers*

Beta-blockers operate by inhibiting the activation of the beta receptors generated by the hormone epinephrine, commonly known as adrenaline, which causes the body to respond. The heart rate reduces due to the slower nerve impulse in response to reduced stimulation, which decreases the heart's metabolic requirement (London, 2021).

Concerning the heart, beta one receptors are primarily responsible for the pace and strength of each beat, whereas beta two receptors are responsible for smooth muscle contractions. Beta-blocker medications are divided into two categories: selective beta-

blockers, which are primarily responsible for acting on beta one receptors, and nonselective beta-blockers, which act on both beta one and beta two receptors. Selective beta-blockers are the most prescribed type of beta-blocker medication.

### *Alpha-Adrenergic Antagonists*

Three types of alpha-blockers are often used for various purposes: nonselective alpha-blockers, selective alpha one blockers, and selective alpha two blockers. Depending on the specific receptor inhibition, it is possible to treat either hypertension or hypotension using alpha-adrenergic antagonists. When the alpha one receptor is inhibited, vasoconstriction is prevented. This is accomplished by blocking catecholamine stimulation. When alpha two receptors are inhibited, the release of norepinephrine is enhanced, on the other hand. Selective alpha one blockers are widely used to treat hypertension due to suppressing norepinephrine activity, resulting in blood vessel dilatation (Klabunde, 2013). Final note: Because alpha two blockers stimulate the sympathetic nervous system, they are not recommended for use in the treatment of hypertension.

### *Intraoperative Blood Pressure*

The deleterious end-organ effects of blood pressure perturbations during surgery are well documented but, there is no consensus regarding safe upper or lower limits. Ethical concerns limit research on finding an exact range of parameters. However, researchers agree on the correlation between the duration of blood pressure instability and the degree of end-organ injury. Prompt treatment of hypotension and hypertension drastically reduces the risk of intraoperative and postoperative organ damage.

### *Intraoperative Causes of Hypotension*

Pressure changes within the abdominal or thoracic cavity will result in a reduction in blood pressure fluctuations. Positive pressure ventilation often results in hypotension due to increased intrathoracic pressure leading to a decrease in preload to the heart (Potchileev et al., 2021). Consequently, the use of carbon dioxide insufflation during laparoscopic surgery occasionally results in a fast decrease in venous return, which causes hypotension (low blood pressure). The abdominal organs and intraperitoneal tissue are pushed towards the diaphragm due to increased intra-abdominal pressure. This increase in pressure causes a decrease in preload and eventually results in hypotension (Yun et al., 2018).

### *Hypovolemia and Blood Loss*

It is standard practice to instruct patients to refrain from eating or drinking anything for at least eight hours or after midnight before a scheduled operation to minimize the danger of aspiration. Because of their NPO state before surgery, patients undergoing general anesthesia are more likely to experience hypotension due to intravascular fluid volume depletion. As hypovolemia is coupled with general anesthesia, a significant hypotensive episode is frequently exacerbated upon induction and throughout the operation until the patient receives adequate fluid replacement and reaches a state of euvoemia. In addition to a fluid volume deficit, blood loss contributes to interoperative hypotension as well.

As a result of the decreased blood volume seen after acute blood loss, a decrease in central venous pressure and heart filling are both seen in response to the event. The result of blood loss results in a decrease in cardiac output as well as arterial pressure. In

response to a drop in blood pressure, the body can swiftly detect it by using its arterial and cardiopulmonary baroreceptors, which subsequently stimulates an increase in the heart's response (increasing its contractions and contractility) and triggers blood vessel constriction (increase systemic vascular resistance) (Klabunde, 2012).

### *Intraoperative Causes of Hypertension*

Causes of acute hypertension during the intraoperative period are multifactorial. Type of surgery, phase of surgery, and depth of anesthesia are a few factors to consider when treating intraoperative hypertension. A careful but comprehensive assessment of the patient and their surroundings is important when considering an intervention. The following sections will examine the causes of acute hypertension during surgery and possible treatments.

#### *Type of Surgery*

Laparoscopic surgery commonly causes hypertension. Increased preload and cardiac output secondary to the displacement of blood from the splanchnic vascular bed results from initial insufflation (Barash et al., 2017). Peritoneal insufflation also stimulates catecholamine release, promoting an increase in afterload, furthering the extent of hypertension. Barash et al. (2017) describes hypertension secondary to insufflation as transient, responding best to increasing the depth of anesthesia. A short-acting vasoactive agent should be considered if the patient's blood pressure does not respond appropriately to increasing anesthetic depth.

Orthopedic, vascular, or other surgeries involving upper and lower extremities may utilize a tourniquet to reduce blood loss. Sympathetic stimulation from tourniquet pain will result in hypertension. Treatment of tourniquet pain includes opioids, hypnotics,

or deflation of tourniquet if appropriate (Barash et al., 2017). Cautiously use vasoactive medications to treat hypertension secondary to tourniquet pain. By the time signs of tourniquet pain manifest, the surgeon may be ready for deflation, therefore removing the source of hypertension.

### *Depth of Anesthesia*

An adequate depth of anesthesia inhibits the body's sympathetic response to noxious stimuli. Conversely, an inadequate depth of anesthesia results in a strong sympathetic response in the presence of a noxious stimulus. Noxious stimuli occurring intraoperatively include direct laryngoscopy (DL), airway instrumentation with an endotracheal tube (ETT), and pain from surgical stimulation. Performing a DL for ETT placement during the induction of anesthesia bypasses protective reflexes (Butterworth et al., 2018). Without adequate sedation, an uninhibited sympathetic response occurs. Pain and surgical stimulation during the maintenance phase of anesthesia also cause hypertension (Naglehout & Elisha, 2018).

The emergence phase of anesthesia poses an interesting challenge. Surgical stimulus is no longer a factor. However, as the patient is weaned from volatile anesthetics and becomes more aware, the sympathetic response to pain is activated. If performing awake extubation, the ETT is a source of sympathetic stimulation and hypertension. Being aware of the potential sources of sympathetic stimulation is important when developing a treatment plan.

### *Target Blood Pressure Goals*

Anesthesia providers typically aim for maintaining intraoperative blood pressure within 10-20% of the patient's baseline while keeping mean arterial pressure (MAP) above 65mmHg (Schonberger et al., 2020). Futier et al. (2017) suggest targeting a relative blood pressure target rather than an absolute threshold. When blood pressure was maintained within 10% of the patient's baseline, rather than maintaining systolic blood pressure (SBP) above 80mmHg, the risk of postoperative organ dysfunction was decreased.

Wesselink et al. (2018) evaluated the duration and degree of intraoperative hypotension. There was a slight increase in mortality for patients with a MAP less than 80 mmHg for 10 minutes or longer, whether absolute or relative to the patient's baseline. However, as blood pressure decreased, a shorter duration of hypotension resulted in increased mortality related to end-organ damage.

The association of intraoperative hypertension with end-organ damage is not clear. Sessler et al. (2019) noted the heterogeneity of evidence related to intraoperative hypertension and adverse outcomes. Guidelines for an upper limit of systolic blood pressure do not exist. However, the initiation of treatment for intraoperative hypertension should be individualized for each patient.

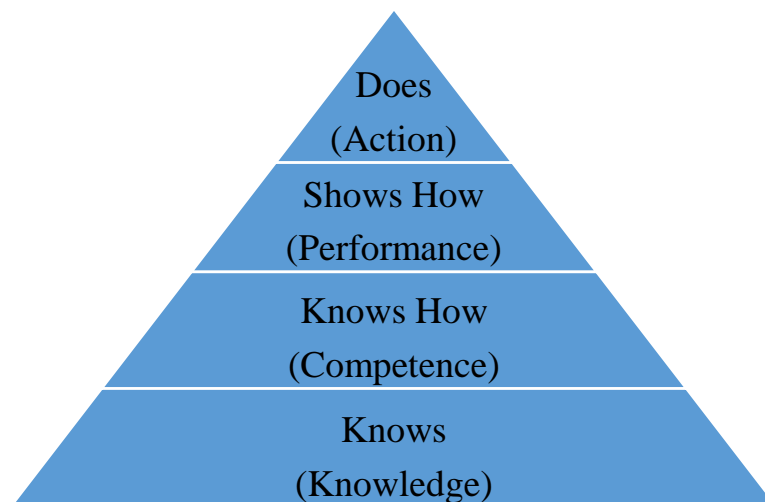
### **Rationale**

Dr. George Miller (1990) acknowledges the lack of an assessment tool that comprehensively evaluates the complexity of delivering professional services by a successful physician. Miller suggests a four-level assessment depicted in a pyramid scheme for ease of explanation. Miller's Pyramid of Assessment creates a framework to



assess the competence of trainees across all medical disciplines. Figure 1 illustrates the four levels of Dr. Miller's framework. The student should progress through the four pyramid levels sequentially, from bottom to top, for optimal performance.

As shown in Figure 1, knowledge is the base of Miller's theory. Adequate knowledge is important for a strong clinical foundation. However, a strong knowledge base alone is insufficient to be an advanced care provider. Trainees display competence by integrating knowledge with subjective and objective data to develop a treatment plan or intervention. The competence of this level is consistent with the second tier of Miller's pyramid, or the Knows How tier (1990). As the student advances to the third tier, or the Shows How tier, the focus transitions to behavior instead of cognition. At this level, trainees participate in a simulation, and the instructor provides an evaluation based on the student's ability to integrate knowledge and decision-making. In the final stage, Does, of Miller's pyramid (1990), the trainee applies skills from the previous tier to perform in a clinical setting.



*Figure 1. Miller's Pyramid of Assessment*

*Note.* Miller, G. E. (1990). The Assessment of Clinical Skills/Competence/Performance. *Academic Medicine*, 65(9).

In accordance with Miller's theory, OSCEs provide a comprehensive assessment of clinical performance without bias. An OSCE clearly defines the skills, problem-solving abilities, and knowledge under scrutiny for the specific scenario (Harden et al., 1975). Students can review the information before the simulation. The instructor provides subjective patient information, and the student assesses the simulated patient for objective information. After synthesizing the information, the student creates and implements a plan. With this format, the OSCE provides trainees with an opportunity to become familiar with clinical scenarios. A structured simulation is repeatable and provides the best evaluation of knowledge base and decision-making skills without causing harm to a human patient. In conclusion, properly executing an OSCE creates a comprehensive assessment and optimizes clinical performance for trainees across medical professions.

#### DNP Essentials

The American Association of Colleges of Nursing (AACN, 2006) created eight foundational criteria necessary for advanced practice nursing providers. The DNP Essentials provide a foundation for this doctoral project to be consistent with the educational requirements of the AACN. At a minimum, doctoral projects must meet the standards outlined by the essentials. The DNP essentials that most closely align within this doctoral project are outlined in the coming sections.

#### *Essential I: Scientific Underpinnings for Practice*

This OSCE created an evidence-based plan for USM NAP students to use when faced with intraoperative hypotension or hypertension. This tool was developed with the support of current literature and an expert panel. The scientific foundation of this OSCE,

in accordance with the AACN (2006) essentials, reflects the complexity related to intraoperative blood pressure management.

*Essential II: Organization and Systems Leadership for Quality Improvement and Systems Thinking*

The AACN (2006) emphasizes the importance of the DNP graduate's role extending beyond the direct patient to focus on larger population. OSCEs are designed to be implemented in educational organizations. Using this tool in education will equip future anesthesia providers with the skills to provide safe, high-quality care.

*Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice*

To create this tool, the researchers performed an extensive literature review regarding learning strategies and intraoperative blood pressure management. The development of this tool encompasses acquiring knowledge and solving a problem by applying the knowledge to practice (AACN, 2006). Ultimately, this tool serves inexperienced SRNAs with a step-wise approach to treating intraoperative blood pressure fluctuations.

*Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care*

Highly technological training systems have become an important part of training medical professionals. Simulation technology will continue to evolve and provide a safe training arena for advanced practice providers. To align with the AACN (2006) DNP essentials, this tool can be used with available simulation technology to train students, ultimately improving patient outcomes.

### *Essential VIII: Advanced Nursing Practice*

The evolution and sophistication of health care require the nursing profession to evolve and become competent in specialized areas. Therefore, preparing advanced practice nurses has become specialized. This tool will prepare SRNAs to practice in the highly specialized area of anesthesia, in accordance with the AACN's (2006) DNP essentials.

#### Specific Aims

The goal of this doctoral project was to develop a training tool serving nurse anesthesia students in treating intraoperative fluctuations in blood pressure. There is an identified knowledge gap, as SRNAs do not have formal training or knowledge regarding intraoperative blood pressure management. A broader goal of this tool was to decrease intraoperative adverse events associated with blood pressure perturbations. Students will use this tool in simulation to become familiar with causes and interventions when faced with hypotension or hypertension intraoperatively.

This tool also aimed to provide instructors with an objective assessment of clinical readiness. Traditional testing methods are important but are unreliable in predicting clinical readiness. Instead of relying strictly on knowledge recall, the OSCE allows instructors to assess a student's decision-making ability. The low-stress environment of the simulation lab promotes decision-making skills when faced with high-risk situations in the clinical environment.

#### Summary

Patient safety is a top priority when providing care. Simulation optimizes patient safety by improving the performance of healthcare workers. Using an OSCE-based

simulation helps SRNAs develop non-technical skills, which are important in managing intraoperative blood pressure. Simulation, in regards to Miller's Pyramid (Miller, 1990), is an opportunity for SRNAs to perform using didactic knowledge acquired through study.

The effects of anesthetic drugs and gases on blood pressure are well documented. This OSCE exposes pre-clinical SRNAs to intraoperative blood pressure fluctuations, ultimately increasing awareness of causes and treatment modalities. Pre-clinical exposure to such an event helps SRNAs maintain patient safety when it occurs during clinical rotations. Lastly, this OSCE aligns with the eight foundational criteria necessary for advanced practice nursing providers according to the AANA.

## CHAPTER II – METHODOLOGY

As health care continues to evolve, patient safety remains a top priority.

Simulation promotes a culture of safety by allowing trainees an opportunity to practice technical and non-technical skills without causing harm to human patients. This doctoral project intended to determine the effectiveness of an OSCE in training pre-clinical SRNAs in managing intraoperative hypertension and hypotension. To comply with the USM College of Nursing and Health Professions policy, the DNP project must align with the DNP Essentials created by the AACN (2006). Refer to Appendix A for the description of how this doctoral project modeled each DNP Essential.

### Context

This OSCE is best for SRNAs with access to high-fidelity simulation equipment. The simulation scenarios are set up to occur in USM's College of Nursing and Health Professions simulation lab. One instructor observes and grades the participants based on the checklist created within the OSCE. Intraoperative blood pressure fluctuations are rarely isolated events. Therefore, this OSCE can stand alone or be used in conjunction with other OSCE scenarios. After the OSCE, an improved situational awareness will help students identify potential causes of intraoperative blood pressure perturbations to determine the most appropriate intervention. This OSCE will be part of a library accessible to students as study aids in the future.

An extensive review of available literature on intraoperative blood pressure management was conducted. The review of literature focused on peer-reviewed scholarly databases and sources. Specifically, the search focused on databases such as Digital Commons, ProQuest, EBSCO Host, Digital Public Library of America, Data USA,

PubMed, Cochrane Library, and Google Scholar. Some of the keywords used in the search included anesthesia complications, preoperative safety checklist, take-home anesthesia evaluation, improved intraoperative care outcomes, improved anesthesia outcomes, anxiety, memory, visual aids, financial burden, surgical case cancellations, compliance with instructions, and adherence to instructions. Across the databases, the initial inclusion criteria entailed articles published in English and less than ten years old. An additional search was performed by altering the inclusion criteria to include literature older than ten years to discover pertinent foundational studies.

### Design

Following the Institutional Review Board (IRB) approval for the doctoral project, the Blood Pressure Management OSCE was constructed and developed. The IRB protocol number for this DNP project is 22-446 and the approval letter is found in Appendix B. Current research, including evidence-based practice and best-practice guidelines, were highly integrated into completing the OSCE. The authors designed the OSCE template, found in Appendix C, to include information pertaining to the overall background and purpose, a step-by-step method to use the OSCE template, as well as a grading rubric including crucial steps that must be met to pass the OSCE. Once entirely constructed, the OSCE was evaluated by the evaluation committee, which consisted of USM CRNA faculty, second-year, and third-year SRNAs in the Nurse Anesthesia Program at USM. Additionally, a grading rubric was developed and approved by the evaluating committee.

## Intervention

The cornerstone of this initiative was established when the USM NAP faculty identified a disorganized sequence within students attempting to manage intraoperative blood pressure, recognizing the need for an organized checklist to better prepare students upon starting clinical rotations. To solve this issue, an OSCE was developed to provide a learning approach that was practicable for the targeted demographic. Best practices in intraoperative blood pressure management were examined before developing the OSCE. The OSCE was built with the primary evidence-based techniques derived from the reviewed research, encompassing this critical knowledge.

The learning tools have precise student objectives that the SRNA must meet. The application also provides a list of books, lectures, videos, and photographs and a step-by-step method, and a curriculum blueprint with a clinical scenario that must be completed before moving on to the assessment phase. Additionally, the tool includes a student debriefing form and an assessment rubric tailored to the patient scenario supplied. Permission will be given after gaining approval from USM's NAP committee and presenting the research to the IRB.

Following IRB permission, a panel of experts was assembled to evaluate and provide input on the research. The DNP project's stakeholders comprised the following USM NAP members: second and third-year SRNAs and four presently practicing CRNAs and faculty members. The experts of the panel are the four CRNA faculty members. The clinical knowledge of the academic staff contributes significantly to criticizing and assessing the defined competencies in the OSCE. The other stakeholders provided a distinct perspective on evaluation because second-year SRNAs have only



recently begun clinical, while third-year SRNAs are nearing completion of their clinical training. The assessments allowed stakeholders to submit anonymous input on the OSCE's strengths or areas of concern.

After committee approval of this doctoral project, the OSCE was presented to the experts and stakeholders via Qualtrics, together with a streamlined literature review containing supporting references and an assessment form. Qualtrics is an automated survey platform that enables survey participants to anonymously answer and submit electronic survey questions. The feedback was then documented and reviewed for potential revisions to this doctoral project. The DNP project committee was informed of the findings and granted modifications. The final OSCE and data overview were presented and disseminated at the USM School of Leadership and Advanced Nursing Practice DNP Research and Scholarship Day. Any electronic and physical data and comments were deleted and destroyed at the end of the research project.

#### Measures

This doctoral project will provide SRNAs with a foundation in managing intraoperative blood pressure, increasing the student's knowledge and skill set. This foundation can boost student confidence, eliminate delayed patient treatment, and reduce unfavorable patient outcomes associated with inadequate skills. Students will be more competent and provide safe patient care once starting clinical rotations after completing the OSCE. The content in the OSCE is up-to-date and evidence-based, and it will provide SRNAs with the tools and abilities needed to manage intraoperative blood pressure appropriately. A survey was issued to the panel of experts, existing USM SRNAs, and licensed CRNAs to evaluate the OSCE and its efficiency.

## Data Collection and Analysis

The data collected using the metrics mentioned above were grouped to reflect a subset of quantitative and qualitative findings. The data necessary to improve this OSCE were gathered using an assessment instrument that was made available online to a group of associate SRNAs, licensed CRNAs, and the four NAP faculty members. After compiling all completed assessment forms, the data was examined, summarized, and analyzed. The OSCE was amended to address panel concerns about intraoperative blood pressure management, to increase SRNA proficiency, and minimizing adverse patient outcomes.

## Ethical Considerations

Among the ethical factors that should be considered is USM NAP's intention to avoid incorporating the OSCE into the curriculum. The faculty may believe that the existing training in intraoperative blood pressure management is adequate for the clinical preparation of SRNAs. SRNAs would not benefit directly from intraoperative blood pressure management simulation if the OSCE was not a necessary element of the program. Without this critical knowledge basis and increased skill set, students may be less confident and knowledgeable when confronted with an actual clinical setting. Respondents were assured of the confidentiality and privacy of their personal information and replies before participation in the survey. There are no potential conflicting interests. To guarantee ethical consideration, this study was submitted to the IRB.

## Summary

The OSCE for Intraoperative Hypotension and Hypertension Management was created to fulfill a knowledge gap among SRNAs new to the clinical arena. The goal of

this doctoral project was to provide USM NAP students with a unique simulation experience in addition to an evaluation of skills after simulation. The OSCE tool and template were developed using evidence-based research. After development the OSCE tool and template were submitted and approved by the IRB. The OSCE was sent via email to 2<sup>nd</sup> year SRNAs, 3<sup>rd</sup> year SRNAs, and licensed CRNAs. Feedback was obtained through an anonymous survey completed by participants. The feedback was collected and evaluated for common themes relayed through the survey responses.

### CHAPTER III – RESULTS

The OSCE template for intraoperative hypotension and hypertension along with supporting documents were sent to practicing CRNAs, USM NAP faculty, and USM SRNAs via email. Following consent and a review of the OSCE tools (Appendix E & F), participants completed a Qualtrics™ survey regarding the content within the OSCE template (Appendix D). First and second-year SRNAs were given the opportunity to participate in this research, along with the five USM NAP faculty. Fifty-six responses were received. The demographics of the respondents are shown in Table 1.

Table 1

*Survey Demographics*

2nd year SRNAs	13
3rd year SRNAs	16
CRNAs	28
<b><u>Total:</u></b>	<b>57</b>

Participants answered eight questions after providing consent. The survey is included in Appendix D. In the first question, 58 respondents consented to participation. Fifty-seven participants responded with their level of practice in the following question. For the remaining questions, 56 responses were recorded. At least 50 participants strongly agree with the clearness and conciseness of the instructions for managing intraoperative hypotension and hypertension. Of the 56 responders, 50 strongly agree on the ability to identify causes of intraoperative hypotension and hypertension during surgery. Participants are asked if they can create a treatment for intraoperative

hypotension and hypertension in questions five and six, respectively. In both questions 51 of the SRNAs and CRNAs strongly agreed on being able to create a treatment plan for intraoperative hypotension and hypertension. One response to question seven disagreed that this OSCE provided all the necessary information for SRNAs to be successful in clinical. However, 50 respondents strongly agreed on this OSCE helps SRNAs be successful in the clinical setting. The results of the survey can be seen in Table 2.

Table 2

*Survey Responses*

	Question 3	Question 4	Question 5	Question 6	Question 7
Strongly agree	91.07% (51)	89.29% (50)	91.07% (51)	91.07% (51)	89.29% (50)
Somewhat agree	7.14% (4)	10.71% (6)	8.93% (5)	8.93% (5)	7.14% (4)
Neither agree nor disagree	1.79% (1)	0.00% (0)	0.00% (0)	0.00% (0)	1.79% (1)
Somewhat disagree	0.00% (0)	0.00% (0)	0.00% (0)	0.00% (0)	1.79% (1)
Strongly disagree	0.00% (0)	0.00% (0)	0.00% (0)	0.00% (0)	0.00% (0)
<b>Total</b>	<b>56</b>	<b>56</b>	<b>56</b>	<b>56</b>	<b>56</b>

N=51, 91%

## Summary

Of the 58 consenting participants, 56 completed the survey. The responses to each question are organized in Table 2. Overall, the participating CRNAs and SRNAs overwhelmingly favor using this OSCE to train first-year SRNAs. Two participants either remain indifferent or disagree with this OSCE containing enough content to aid in the success of new SRNAs. However, based on the resounding positive sentiment from the other participants, we remain confident this OSCE will aid SRNAs in developing the necessary skills to manage intraoperative blood pressure perturbations.

## CHAPTER IV – DISCUSSION

Based on the results of the survey, implementing this OSCE in simulation would be beneficial for SRNAs. Almost 90% of respondents agree on this OSCE aiding in the clinical success of SRNAs. This OSCE template is unique in its ability to stand alone or be used in conjunction with another OSCE template during simulation. The importance of non-technical cannot be overstated. Managing intraoperative hypotension and hypertension is a non-technical skill that will develop as a result of implementing this OSCE template in simulation.

### Interpretation

Survey participants overwhelmingly agree on the usefulness of the OSCE for Intraoperative Hypotension and Hypertension Management and its supporting documents. The versatility of this OSCE template allows for faculty to solely evaluate blood pressure management. Faculty could also combine this OSCE with a separate OSCE during simulation. Depending on the student's level of competence, it may be more beneficial to master one OSCE at a time before combining OSCE templates in one simulation scenario. This OSCE could also have a role outside of simulation. For example, it could be used as continuing education credits for licensed CRNAs. Lastly, modifications could be made to the template for specific disease processes or surgeries.

### Limitations

All research has limitations, and this doctoral project is no exception. One weakness that stands out is the small sample size. The survey could have been sent to more clinical instructors and SRNAs from other universities. With more time this OSCE could have been implemented in a simulation scenario with students. Additionally, a pre-

simulation evaluation, a debriefing session, and a post-simulation evaluation could have provided different results. These limitations can be considered when future research on OSCEs is conducted.

### Future Considerations

This OSCE is designed for blood pressure management in otherwise healthy patients presenting for surgery. An interesting future consideration is researching evidence-based practices for the intraoperative blood pressure measurement associated with certain conditions. Modifying this OSCE tool and template for blood pressure management for patients with a pheochromocytoma or a carcinoid tumor would help SRNAs expand their knowledge base. Another OSCE tool and template concerning intraoperative blood pressure management could be developed for specific, high-risk surgeries such as coronary artery bypass graft, carotid endarterectomy, and neurosurgery cases

Lastly, this OSCE is designed to be used within a simulation scenario. Future research could focus on the use of combining multiple OSCE scenarios into one “mega-OSCE.” Researchers could reveal the benefits or limitations to combining multiple OSCEs into one simulation scenario. Additional investigations may provide insight into a limit to the number of OSCE templates included in a single simulation scenario to prevent it from becoming too cumbersome.

### Summary

An important strength of the survey results is the preponderance of responses from practicing CRNAs. Based on the data, we have identified an existing knowledge gap among new SRNAs. The blood pressure management tools and OSCE template



provided in this doctoral project can help first-year SRNAs develop non-technical skills related to intraoperative blood pressure management. Promptly identifying and treating intraoperative hypotension and hypertension is paramount in keeping the patient safe from end-organ damage. As this OSCE template is incorporated with USM NAP's OSCE library, first-year SRNAs will have more confidence and success when transitioning from the classroom to the clinical setting.

APPENDIX A – DNP Essentials

DNP Essentials	Clinical Implications
<u>Essential I</u> Scientific Underpinnings	Literature review on the evidence-based practices of intraoperative blood pressure management presented through an OSCE to improve student competence and increase patient safety.
<u>Essential II</u> Organizational and Systemes Leadership for Quality Improvement and Systems Thinking	This OSCE template will contribute to the education and training for current and future SRNAs at USM.
<u>Essential III</u> Clinical Scholarship and Analytical Methods for Evidence- Based Practice	Use of literature review to create and implement an OSCE template containing evidence-based practice guidelines.
<u>Essential IV</u> Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care	This OSCE Template can be used alone or in conjunction with another template during high fidelity simulation to provide SRNAs with a realistic and safe practice environment..
<u>Essential V</u> Healthcare Policy for Advocacy in Health Care	This project advocates for an improvement in learning methods by utilization of an OSCE by students with a goal of increased positive health outcomes.
<u>Essential VI</u> Interprofessional Collaboration for Improving Patient and Population Health Outcomes	Collaboration with licensed CRNAs based on their advanced knowledge and experience in practice.
<u>Essential VII</u> Clinical Prevention and Population Health for Improving the Nation’s Health	Implementation of a standardized educational tool to improve SRNAs' preparedness and decrease the amount of bad patient outcomes related to student error or delayed care.
<u>Essential VIII</u> Advanced Nursing Practice	Using this OSCE with high-fidelity simulation technology to aid SRNAs in developing non-technical skills associated with providing anesthesia.

## APPENDIX B – IRB Approval Letter

### Office of Research Integrity



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#### NOTICE OF INSTITUTIONAL REVIEW BOARD ACTION

The project below has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services regulations (45 CFR Part 46), and University Policy to ensure:

- The risks to subjects are minimized and reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered involving risks to subjects must be reported immediately. Problems should be reported to ORI via the Incident submission on InfoEd IRB.
- The period of approval is twelve months. An application for renewal must be submitted for projects exceeding twelve months.

PROTOCOL NUMBER: 22-446  
PROJECT TITLE: Objective Structured Clinical Exam for Intraoperative Hypotension and Hypertension Management  
SCHOOL/PROGRAM Leadership & Advanced Nursing  
RESEARCHERS: PI: James David Ingram  
Investigators: Ingram, James David-McGinity, Andrew-Parks, Stephanie-Rayborn, Michong-  
IRB COMMITTEE ACTION: Approved  
CATEGORY: Expedited Category  
PERIOD OF APPROVAL: 06-Jul-2022 to 05-Jul-2023

Donald Sacco, Ph.D.  
Institutional Review Board Chairperson

APPENDIX C – OSCE Template

**ANESTHESIA OBJECTIVE STRUCTURED CLINICAL EXAM**  
**Intraoperative Hypotension and Hypertension Management**

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**LEARNER OUTCOMES:**

1. Understanding the effects of anesthesia on physiologic blood pressure control
2. Recognizing causative factors of intraoperative blood pressure perturbations
3. Managing intraoperative hypotension
4. Managing intraoperative hypertension

**DOMAINS:**

<u>Cognitive</u> - recalling the physiologic mechanisms of blood pressure control, applying the appropriate blood pressure cognitive aid to a given situation
<u>Affective</u> – allowing an appropriate amount of time between interventions to evaluate the effectiveness prior to implanting further interventions
<u>Psychomotor</u> – analyzing the potential contributory factors of the increased or decreased blood pressure, promptly treating blood pressure based on situational analysis
<u>Formative Evaluation</u> - feedback

**PURPOSE:** The purpose of this OSCE is to assess the student’s ability to manage intraoperative hypotension or hypertension and to begin developing this non-technical skill

**LEARNER OBJECTIVES:**

1. Identify potential causes of intraoperative hypotension and hypertension
2. Demonstrate effective situational analysis leading to prompt development of a treatment plan
3. Appropriately treat blood pressure perturbation based on the gathered information

**INDIVIDUAL OR GROUP OSCE:** Individual or Group

**REQUIRED READING and ASSOCIATED LECTURES:**

1. Nagelhout, J. J., & Elisha, S. (2018). Autonomic and Cardiac Pharmacology. In *Nurse anesthesia* (6<sup>th</sup> ed., pp. 165-189). Elsevier.
2. Cognitive aids for intraoperative management of hypotension and hypertension

**REQUIRED PARTICIPANTS:** Volunteer SRNA, NAP faculty examiner, simulation lab staff

**VENUE:** USM Simulation Lab

**STUDENT LEVEL OF OSCE (CIRCLE ONE):** Semester 1-3   Semester 4-6  
Semester 7-9

**TIME ALLOTTED:** 15-20 minutes

**SEQUENTIAL PRACTICE & TESTING:** The primary purpose of this OSCE is for evaluation. Therefore, no further testing is necessary.

**RECOMMENDED PRACTICE PRIOR TO EXAMINATION:** 75-100 minutes (using this OSCE for 5 separate rounds); required readings prior to simulation  
You are on call. Mr. Allen, a 22-year-old male, presents to the emergency room with

**CONTENT OUTLINE**

10/10 abdominal pain. The patient started experiencing mild abdominal after dinner yesterday evening. This morning, the pain had almost resolved and the patient carried on with his normal routine. The pain resurfaced around noon and progressively got worse so he decided to go to the ED after work at 1700. It is currently 2200. He is admitted to the general surgery team after being diagnosed with appendicitis. He is transported to the pre-operative holding area in preparation for an emergency laparoscopic appendectomy. Physical exam remarkable for rebound abdominal pain. The patient is 6' tall and weighs 92 kg. No significant past medical history. No prescribed medications; he only takes a multivitamin. Pre-operative vital signs: HR 95, BP 119/71, SaO<sub>2</sub> 99%, on RA, RR 14.

NPO Status: 3 cups of black coffee; last one around 0800. Unable to eat because of abdominal pain

Pre-Op Labs/Images

CXR: No acute pathology noted

EKG: Sinus Tach; no T-wave abnormality; normal Q-T segment

CBC: WBC 15, Hgb 12, HCT 37, PLT 160

POC Glucose: 92

**EQUIPMENT& SUPPLIES:**

1. Anesthesia Machine with adult breathing circuit
2. SIM MAN
3. 5cc, 10cc, and 20cc syringes
4. 100cc bag of NS for drug reconstitution
5. Monitors:
  - a. 3-lead electrocardiogram
  - b. Pulse oximeter
  - c. Blood pressure cuff
  - d. Gas sampling line
  - e. Thermometer
6. Airway Equipment:
  - a. Appropriate size LMA
  - b. Correct size ETT with stylet

- c. Handle and blade for direct laryngoscopy
  - d. Oral airway/nasal trumpet
  - e. Eschmann airway exchange device
  - f. 10cc syringe
7. Medications
- a. IV induction drugs: lidocaine, rocuronium, propofol, succinylcholine
  - b. Pain management: fentanyl
  - c. IV fluids
  - d. Anti-emetic drugs: ondansetron, dexamethasone
  - e. Anti-hypertensives: labetalol, metoprolol, hydralazine, nitroglycerine, esmolol
  - f. Sympathomimetics: phenylephrine, ephedrine, vasopressin, norepinephrine, epinephrine
8. Yankauer and suction tubing
9. Tape

**SITE SELECTION:**

Cardiac and autonomic nervous system

**TASK STATEMENT:**

Your task is to determine the nature of this patient's blood pressure perturbation. Select a treatment modality based on your rapid analysis. After an intervention is chosen and implemented, evaluate the result of the intervention. If the blood pressure problem persists, re-evaluate and implement subsequent interventions as necessary.

**PROCESS**

1. Apply monitors and obtain a set of pre-induction vital signs. Pre-induction vitals are within normal limits.
2. Adequately pre-oxygenate.
3. Proceed with induction drugs and airway instrumentation.
4. Ensure airway is secured and eye protection is applied.
5. Prepare for incision.

**TRIGGER EVENT:** After an uneventful induction and intubation, you continue to prepare for incision. You optimize padding and positioning to avoid nerve injury. After confirming return of twitches with a nerve stimulator, you administer an appropriate dose of a muscle relaxant. A convection warmer is applied. It has been 15 minutes since induction drugs were administered. You begin documenting and notice the patient has progressively become hypotensive. The patient's blood pressure is now 20% below baseline.

- i. Cycle blood pressure cuff to rule out erroneous reading
- ii. Assess other vital signs and compare to baseline
- iii. Determine the level of anesthetic gas.

- iv. Assess ventilator pressures and waveforms
- v. Is IV functional and dripping?
- vi. Decide if hypotension should be treated with vasopressor or

**TRIGGER EVENT:** The patient's blood pressure has returned to within 20% of his baseline. 30 minutes after induction, the surgeon scrubs into the OR and makes incision. The operation was uneventful. 20 minutes after incision, the appendix is successfully removed and the trocars are being removed from the patient's abdomen. You reverse the muscle relaxant and turn off the volatile anesthetic. The patient's blood pressure progressively increases and is now 180/99; the HR is 112 and the patient is tachypneic with a RR of 28.

- i. Cycle blood pressure cuff to rule out erroneous reading
- ii. Assess other vital signs and compare to baseline
- iii. Review the amount of pain medicine the patient has received and the time since the last dose
- iv. Assess airway pressures, tidal volumes, and RR
- v. Determine if hypertension should be treated with pain medicine or antihypertensive

DEBRIEFING FORM:

1. Were you able to successfully identify the cause and treat the patient's hypotension or hypertension?
2. Would you have done anything different to better prepare for this OSCE? (ex. study drug dosages/mechanisms of action, etc.? ANS A&P? Effects of specific surgery?)
3. Is the suggested practice sufficient to give you confidence in managing intraoperative blood pressure perturbations? Why or why not?
4. What were you least comfortable doing? What were you most comfortable doing?
5. Were you satisfied with your decisions? Would you have done anything differently with your interventions?



## ASSESSMENT

<b>Rubric for Objective Structured Clinical Exam for Intraoperative Hypotension and Hypertension Management</b>
---

**QUESTION & DEMONSTRATION STATION:**

	TASKS	PASS	FAIL	COMMENTS
	1. Prepares and selects appropriate equipment			
*	2. Recognizes potential causes of intraoperative hypotension			
*	3. Recognizes potential causes of intraoperative hypertension			
*	4. Selects appropriate treatment for hypotension			
*	5. Selects appropriate treatment for hypertension			
*	6. Promptly treats blood pressure disturbance			
	7. Allows appropriate time to pass between interventions			

**Steps with \* Must be properly completed. All steps must be completed/passed to receive a passing grade.**

The student's OSCE demonstrates the foundations of managing intraoperative blood pressure during the presence of hypotension or hypertension: (Circle one) **PASS**  
**FAIL**

Does the student need to repeat this OSCE at a later date to satisfy learning requirements? (Circle one) **YES NO Date to return for evaluation: \_\_\_\_\_**

EXAMINER: \_\_\_\_\_ DATE: \_\_\_\_\_

APPENDIX D – Survey Questions

1. Do you consent to participate in the evaluation of the OSCE intraoperative hypotension and hypertension management?		
a. Yes		b. No
2. Please select one that applies to your current anesthesia practice role		
a. 2nd year SRNA	b. 3rd year SRNA	c. CRNA
3. This OSCE presented clear and exact instructions on managing intraoperative hypotension and hypertension		
a. Strongly agree	b. Somewhat agree	c. Neither agree nor disagree
d. Somewhat disagree	e. Strongly disagree	
4. After participating in this OSCE, I am able to identify the possible causes of intraoperative hypotension and hypertension		
a. Strongly agree	b. Somewhat agree	c. Neither agree nor disagree
d. Somewhat disagree	e. Strongly disagree	
5. After participating in this OSCE, I am able to create a treatment plan for intraoperative HYPOTENSION		
a. Strongly agree	b. Somewhat agree	c. Neither agree nor disagree
d. Somewhat disagree	e. Strongly disagree	
6. After participating in this OSCE, I am able to create a treatment plan for intraoperative HYPERTENSION		
a. Strongly agree	b. Somewhat agree	c. Neither agree nor disagree
d. Somewhat disagree	e. Strongly disagree	
7. This OSCE includes all of the necessary information to help SRNAs be successful in the clinical setting		
a. Strongly agree	b. Somewhat agree	c. Neither agree nor disagree
d. Somewhat disagree	e. Strongly disagree	
8. Please add any recommendations or comments that you have for this OSCE on the management of hypotension and hypertension.		

APPENDIX E – OSCE Tool for Hypotension

Management of Hypotension	Box A: Potential Underlying Issues	
<p><b><u>Pre-Operative Assessment</u></b>                      Consider the following pathophysiology in relation to your patient: Sepsis, Cardiac Valvular or ischemia, trauma blood loss, hypovolemia, sympathetic blockade, antihypertensive drugs, arrhythmias, pulmonary events</p> <p><b><u>Pre-operative Action</u></b>                      - Consider pre-op fluid bolus                      - Transfusion if warranted by low H&amp;H</p> <p><b><u>Intra-operative Action</u></b>                      1. Increase FGF, give 100% oxygen and check FiO<sub>2</sub>.                      2. Inspect the breathing circuit, valves, and connections.                      3. Verify movement of reservoir bag or ventilator bellows.                      4. Evaluate airway placement &amp; breath sounds (including larynx and stomach).                      5. Assess Chest symmetry, rate, SpO<sub>2</sub>, TVE, ETCO<sub>2</sub> waveform verifying airway patency. (Consider passing a suction catheter).                      6. Manually ventilate to feel airway pressure. Eliminate excessive intrathoracic pressure.                      7. Check HR, rhythm, perfusion, and recheck BP.                      8. HR &lt;60 bpm considers given an anticholinergic drug (Box B).                      9. Vasopressor (Box C) &amp; place in Rev Trendelenburg to <i>alleviate</i> severe hypotension.                      10. Cogitate fluid bolus → reevaluate every 250ml                      11. HR &gt;100 bpm sinus rhythm, treat as hypovolemia: give IV fluid bolus.                      12. Determine an appropriate anesthetic depth &amp; pain relief (consider the risk of awareness).                      13. Check for possible surgical causes (Box A) &amp; discuss them with the surgical team.                      14. Examine the factors in Box A and call for help if the problem isn't easily resolved.</p>	Surgical Causes	Excessive anesthetic depth Hypovolemia Blood loss Vagal Reaction ↓ Venous return Embolism  Drug error Pneumothorax LAST SEPSIS Endocrine (steroid-dependent) Anaphylaxis Cardiac Ischemia/Valvular Problem Cardiac Tamponade
	Other Causes	
	<b>Box B: ANTICHOLINERGIC DRUGS</b>	
	Glycopyrrolate 0.2mg IV Atropine 0.04 mg/kg IV	
<b>Box C: VASOPRESSOR DRUGS</b>		
<b>Ephedrine</b> 5-10 mg IV bolus <b>Phenylephrine</b> 50-100mcg IV bolus <b>Norepinephrine</b> 10-40mcg/min Inf. <b>Vasopressin</b> 1-2units IV Bolus <b>Epinephrine</b> 5-10mcg IV Bolus 0.05-2 mcg/kg/minute IV Inf., Cardiac Arrest 0.5 mg (5 mL) IV q5min		

APPENDIX F – OSCE Tool for Hypertension

Management of Hypertension	Box A: Potential Underlying Issues
<p><b><u>Pre-Operative Assessment</u></b>            Did the patient miss a dose of blood pressure medicine?</p> <p><b><u>Pre-operative Action</u></b>            Consider pre-op dose of blood pressure medicine if hypertensive</p> <p><b><u>Intra-operative Action</u></b></p> <ol style="list-style-type: none"> <li>1. Check location and size of blood pressure cuff</li> <li>2. Re-check blood pressure; consider checking in different extremity</li> <li>3. Confirm adequate fresh gas flow delivery and MAC level</li> </ol> <p>Vaporizer adequately filled with volatile agent?</p> <ol style="list-style-type: none"> <li>4. Assess breathing system for faulty valves              Ensure tight connections throughout circuit</li> <li>4. Assess airway device for proper placement              Confirm with auscultation and capnograph</li> <li>5. Increase depth of anesthesia/analgesia</li> <li>6. If hypertension persists, consider underlying cause (Box A)</li> <li>7. Treat with IV anti-hypertension medication if problem still persists (Box B)</li> <li>8. Call for help; consider intra-arterial BP monitoring</li> </ol>	<p>Inadequate anesthesia            Drug error            Distended bladder            Tourniquet pain            Local anesthetic with vasopressor administered by surgeon            Hypervolemia            Seizure            Thyroid storm            Intracranial Hypertension            Pheochromocytoma</p> <p style="background-color: #f8d7da; border: 1px solid #f5c6cb; padding: 2px;"><b>Box B: Drug choices for Hypertension</b></p> <p><b><u>Short Acting:</u></b>            Propofol 1-2 mg/kg; DOA 5-10 min            Esmolol 25-50 mg; DOA 5-10 min            Nitroglycerin Infusion            5-100 mcg/min; DOA 5-10 min</p> <p><b><u>Intermediate Acting:</u></b>            Fentanyl 50-100 mcg; DOA 0.5-1 h</p> <p><b><u>Long Acting:</u></b>            Metoprolol 5mg; DOA 3-4 h            Labetolol 10-20 mg q10 min; DOA 3-6 h            Hydralazine 10-20 mg; DOA 4-6 h</p>

## REFERENCES

- American Association of Colleges of Nursing (2006). *The essentials of doctoral education for advanced nursing practice*. <https://www.aacnnursing.org/Portals/42/Publications/DNPEssentials.pdf>
- Aronowitz, T., Aronowitz, S., Mardin-Small, J., & Kim, B. (2017). Using Objective Structured Clinical Examination (OSCE) as Education in Advanced Practice Registered Nursing Education. *Journal of Professional Nursing, 33*(2), 119–125. <https://doi.org/10.1016/j.profnurs.2016.06.003>
- Ballister, M. M. (2018). Basics of the Objective Structured Clinical Exam. *AANA Journal*. Retrieved September 2021, from [https://www.aana.com/docs/default-source/aana-journal-web-documents-1/journal-online-content/online-content-education-news-basics-of-the-objective-structured-clinical-exam-april-2018.pdf?sfvrsn=34525fb1\\_6](https://www.aana.com/docs/default-source/aana-journal-web-documents-1/journal-online-content/online-content-education-news-basics-of-the-objective-structured-clinical-exam-april-2018.pdf?sfvrsn=34525fb1_6).
- Barash, P. G., Cullen, B. F., Stoelting, R. K., Cahalan, M. K., Stock, M. C., Ortega, R., Sharar, S. R., & Holt, N. F. (2017). *Clinical anesthesia*. Wolters Kluwer.
- Butterworth, J. F., Mackey, D. C., & Wasnick, J. D. (2018). *Morgan & Mikhail's clinical anesthesiology*. McGraw-Hill Education.
- Flood, P., Rathmell, J. P., & Shafer, S. (2015). *Stoelting's Pharmacology & Physiology in Anesthetic Practice* (5th ed.). Wolters Kluwer.
- Futier, E., Lefrant, J.-Y., Guinot, P.-G., Godet, T., Lorne, E., Cuvillon, P., Bertran, S., Leone, M., Pastene, B., Piriou, V., Molliex, S., Albanese, J., Julia, J.M., Tavernier, B., Imhoff, E., Bazin, J.-E., Constantin, J.-M., Pereira, B., & Jaber, S. (2017). Effect of Individualized vs Standard Blood Pressure Management

- Strategies on Postoperative Organ Dysfunction Among High-Risk Patients Undergoing Major Surgery. *Jama*, 318(14), 1346–1357.  
<https://doi.org/10.1001/jama.2017.14172>
- Harden, R. M., Stevenson, M., Downie, W. W., & Wilson, G. M. (1975). Assessment of clinical competence using objective structured examination. *British Medical Journal*, 1(5955), 447–451. <https://doi.org/10.1136/bmj.1.5955.447>
- Klabunde, R. (2013, June 25). *Alpha-Adrenoceptor Antagonists (Alpha-Blockers)*. CV Pharmacology Concepts. <https://cvpharmacology.com/vasodilator/alpha>
- Kohn, L. T., Corrigan, J. M., & Donaldson, M. S. (Eds.). (2000). *To Err Is Human Building a Safer Health System*. National Academy Press.
- Kremer, M. J., Hirsch, M., Geisz-Everson, M., Wilbanks, B. A., Clayton, B. A., Boust, R. R., & Jordan, L. (2019). Preventable Closed Claims in the AANA Foundation Closed Malpractice Claims Database. *AANA Journal*, 87(6), 468–476.
- London, M. J. (2021, July 13). *Hemodynamic management during anesthesia in adults*. Retrieved July 26, 2021, from <https://www.uptodate.com/contents/hemodynamic-management-during-anesthesia-in-adults#H1879584608>
- Miller, G. E. (1990). The Assessment of Clinical Skills/Competence/Performance. *Academic Medicine*, 65(9); S63-S67.
- Morris, R. W., Watterson, L. M., Westhorpe, R. N., & Webb, R. K. (2005). Crisis management during anaesthesia: hypotension. *Quality & safety in health care*, 14(3), e11. <https://doi.org/10.1136/qshc.2002.004440>
- Nagelhout, J. J., & Elisha, S. (2018). *Nurse anesthesia*. Elsevier.

- Paix, A. D., Runciman, W. B., Horan, B. F., Chapman, M. J., & Currie, M. (2005). Crisis management during anaesthesia: hypertension. *Quality and safety in health care*, 14(3), e12. <https://doi.org/10.1136/qshc.2002.004127>
- Parks, R., Warren, P. M., Boyd, K. M., Cameron, H., Cumming, A., & Lloyd-Jones, G. (2007). The Objective Structured Clinical Examination and student collusion: marks do not tell the whole truth. *Journal of Medical Ethics*, 32(12), 734–738. <https://doi.org/10.1136/jme.2005.015446>
- Potchileev, I., Doroshenko, M., & Mohammed, A. N. (2021). *Positive Pressure Ventilation*. PubMed; StatPearls Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK560916/>
- Schonberger, R. B., Fontes, M. L., & Selzer, A. (2020, April 22). *Anesthesia for patients with hypertension*. Retrieved March 3, 2021, from [https://www.uptodate.com/contents/anesthesia-for-patients-with-hypertension?sectionName=Laryngoscopy+and+endotracheal+intubation&topicRef=94532&anchor=H1422299635&source=see\\_link#H1422299635](https://www.uptodate.com/contents/anesthesia-for-patients-with-hypertension?sectionName=Laryngoscopy+and+endotracheal+intubation&topicRef=94532&anchor=H1422299635&source=see_link#H1422299635)
- Sessler, D. I., Bloomstone, J. A., Aronson, S., Berry, C., Gan, T. J., Kellum, J. A., Plumb, J., Mythen, M. G., Grocott, M. P., Edwards, M. R., Miller, T. E., Edwards, M. R., Ackland, G. L., Brudney, C. S., Cecconi, M., Ince, C., Hamilton, M. (2019). Perioperative Quality Initiative consensus statement on intraoperative blood pressure, risk, and outcomes for elective surgery. *British Journal of Anaesthesia*, 122(5), 563–574. <https://doi.org/10.1016/j.bja.2019.01.013>

- Wesselink, E. M., Kappen, T. H., Torn, H. M., Slooter, A. J., & van Klei, W. A. (2018). Intraoperative hypotension and the risk of postoperative adverse outcomes: a systematic review. *British Journal of Anaesthesia*, *121*(4).  
<https://doi.org/10.1016/j.bja.2018.04.036>
- Wunder, L. (2016.). Effect of a Nontechnical Skills Intervention on First-Year Student Registered Nurse Anesthetists' Skills During Crisis Simulation. *AANA Journal*, *84*(1), 46–51.
- Yun, M., Kim, G. H., Lee, S. Y., Cho, H., Kim, B. U., Koo, M. S., & Kwon, M.-Y. (2018). Hypotension due to compression of the inferior vena cava by intrathoracic herniation of peritoneal fat during laparoscopic surgery - A case report - *Anesthesia and Pain Medicine*, *13*(1), 72–76. <https://doi.org/10.17085/apm.2018.13.1.72>