12-2023

An Objective Structured Clinical Examination for Anesthetic Management of Pheochromocytoma

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AN OBJECTIVE STRUCTURED CLINICAL EXAMINATION FOR ANESTHETIC MANAGEMENT OF PHEOCHROMOCYTOMA

by

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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

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December 2023

Published by the Graduate School

ABSTRACT

Pheochromocytoma, whether recognized or unrecognized, has the potential to cause severe cardiovascular complications during surgery. This paper focuses on the creation and importance of an Objective Structured Clinical Examination (OSCE) and a short trigger film focused on the anesthetic management of pheochromocytoma. This OSCE intends to help prepare students to recognize and treat undiagnosed or improperly managed pheochromocytoma in the didactic phase of their learning so as to better prepare them for the possible real-life scenario.

The pathophysiology of pheochromocytoma regarding the catecholamines epinephrine and norepinephrine are discussed along with their potential to wreak havoc on the patient. The treatment algorithm is summarized into a concise and potentially handheld cognitive aid for quick reference of any anesthesia provider. The overriding goal of this project is to help improve patient outcomes. The participants in this OSCE were also the judges of its effectiveness. After a video and short trigger film were viewed, participants graded the project with the use of the provided survey questions. Overwhelmingly the feedback was positive, participants stating that the OSCE was beneficial in that they are now better able to identify and treat pheochromocytoma signs and symptoms.

ACKNOWLEDGMENTS

We would like to thank all our professors for the educational and moral support throughout the making of this OSCE. We thank our committee chair, Dr. Nina McLain, and our committee member, Dr. Mary Jane Collins for their expertise. Also, thank you to all the survey participants for the valuable input.

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LIST OF ILLUSTRATIONS

LIST OF ABBREVIATIONS

AACN	American Association of Colleges of Nursing
A1	Alpha 1
A2	Alpha 2
B1	Beta 1
B2	Beta 2
CRNA	Certified Registered Nurse Anesthetists
DNP	Doctor of Nursing Practice
EBP	Evidenced-Based Practice
IRB	Institutional Review Board
NAP	Nurse Anesthesia Program
OSCE	Objective Structured Clinical Examination
OR	Operating Room
PBZ	Phenoxybenzamine
SRNA	Student Registered Nurse Anesthetists
USM	The University of Southern Mississippi

CHAPTER I – INTRODUCTION

Pheochromocytoma is a rare tumor type that originates in chromaffin cells (Pheochromocytoma, 2021). Chromaffin cells lie in the inner layer of the adrenal glands called the adrenal medulla (Pheochromocytoma, 2021). Under normal physiological circumstances, chromaffin cells release the catecholamines epinephrine and norepinephrine upon biological command, with epinephrine constituting the most considerable amount (Nagelhout & Elisha, 2018). When pheochromocytoma develops, this ratio swaps, mostly secreting norepinephrine and less epinephrine (Nagelhout & Elisha, 2018).

Undiagnosed or incorrect treatment of patients with pheochromocytoma can have adverse outcomes. In one study, cardiovascular-related events (myocardial infarction, stroke) were increased fourteen-fold in patients with pheochromocytoma (Patel, 2020). This same study showed that pheochromocytomas could also be insidious, with 64% of patients having a reduction in blood pressure after surgery, and 1/3 were normotensive (Patel, 2020). Due to these statistics, it is practical for Certified Registered Nurse Anesthetists (CRNAs) to be vigilant in their pre-operation examination and have proper drugs and supplies on standby to treat symptoms and prevent avoidable cardiovascular events.

Statement of the Problem

Understanding the proper anesthetic management of a pheochromocytoma is crucial for preventing cardiovascular complications during surgery. OSCEs are effective in teaching and improving student performance through hands-on application of material covered during lectures; however, The University of Southern Mississippi (USM) Nurse

Anesthesia Program (NAP) does not currently have an OSCE for the anesthetic management of pheochromocytoma. To fill the needs of the USM NAP student registered nurse anesthetist (SRNA) and faculty, an OSCE was developed to further enhance student learning by bridging the gap between the didactic and clinical settings. In addition, a trigger film was developed depicting an active surgical pheochromocytoma emergency in a simulated environment.

Significance of the Problem

Although students' perception of the effectiveness of an OSCE is small, their performance improved significantly compared to before the use of an OSCE (Kim et al., 2020). In a study of forty-three South Korean medical students, four domains of the study were compared. There were at least nine points in each of the four, with the physical exam/patient interaction having the most significant improvements (Kim et al., 2020). Students typically are less stressed when studying or training amongst peers because students do not possess the ability to grade performance permanently. Students consider OSCEs useful for sharpening skills and learning greater detail for their clinical subject (Müller et al., 2018). Trigger films are two to four minutes in duration that include audio and visual components of likely clinical scenarios that exercise a student's reaction time and critical thinking during unexpected clinical changes (Hartland et al., 2003).

Available Knowledge

Norepinephrine predominantly stimulates Alpha 1 (A1), Alpha 2 (A2), and Beta 1 (B1) receptors (Aygun & Uludag, 2020). Epinephrine predominantly stimulates B1 and Beta 2(B2) receptors (Aygun & Uludag, 2020). Alpha 1 receptors are found in the smooth muscle of the body's arteries and veins, and stimulation causes vasoconstriction

(Aygun & Uludag, 2020). Alpha 2 receptors are located in the pre-synaptic junction, and their stimulation causes less norepinephrine to be released, which results in vasodilation, acting as a self-limiting mechanism (Aygun & Uludag, 2020). Beta 1 receptors increase the inotropy and chronotropy of the heart when stimulated (Aygun & Uludag, 2020). Finally, B2 receptors help vasodilate skeletal muscle arteries and bronchodilate (Aygun & Uludag, 2020).

Typical signs and symptoms of pheochromocytoma include (but are not limited to) hypertension, headaches, hyperhidrosis, and heart palpitations (Pheochromocytoma, 2021). Hypertension is the most characteristic of these findings but may not always be present (Pheochromocytoma, 2021). Other symptoms that may occur include angina, nausea and vomiting, fatigue, and weight loss (Pheochromocytoma, 2021). The fatigue and weight loss are due to the hypermetabolic state caused by the release of catecholamines.

The incidence of pheochromocytoma is two to eight per million people, and the prevalence of pheochromocytoma in outpatients with hypertension is 0.1-0.6% in adults (Aygun & Uludag, 2020). As mentioned in the introduction, these statistics only show the patients with signs and symptoms and that up to 64% of patients have a reduction in blood pressure after surgery (Patel, 2020). In another study in Alberta, Canada, there was an incidence of 0.33 cases per 100,00 people per year, and females made up a slightly more significant portion of that than males (Leung et al., 2021).

The cause of death from untreated and/or undiagnosed pheochromocytoma can range from myocardial infarction, heart failure, stroke, or hemodynamic crises/lability (Patel, 2020). Patients with pheochromocytoma are at an increased risk of death. In one

long-term study, 42 patients with pheochromocytoma died after adrenalectomy compared to 23.6 without pheochromocytoma (Patel, 2020). In addition, pheochromocytoma can re-occur after resection, warranting the same vigilant patient care as if they still have the tumor (Patel, 2020).

Rationale

With the use of an OSCE and a short trigger film, SRNAs, and CRNAs will have a valuable educational tool at their command to either learn about or refresh their memory of the underpinnings of pheochromocytoma and how to treat/prevent side effects. With the statistics mentioned previously in this project, it is necessary to understand pheochromocytoma to anticipate and treat these patients correctly.

Framework and Theories

Pretreatment of the patient in the preoperative phase can help reduce morbidity (Araujo-Castro et al., 2021). Pretreatment involves adequate parenteral hydration and the administration of an alpha-receptor blocker (Araujo-Castro et al., 2021). Administration of an alpha-receptor blocker will help attenuate systemic vasoconstriction. Alpha receptor blockers are typically given one to three weeks before surgery to allow time for stabilization of blood pressure and fluid resuscitation (Nagelhout & Elisha, 2018). Systemic vasoconstriction occurs due to A1 stimulation from the release of norepinephrine. The cause of norepinephrine release can be caused by tumor manipulation during surgery or stress in general (Yadav et al., 2022).

There are two types of alpha-blockers, selective and non-selective. A common choice for a non-selective blocker is phenoxybenzamine (PBZ), which blocks both A1 and A2 receptors non-competitively (Yadav et al., 2022). However, this irreversible

blockade can cause postoperative hypotension (Yadav et al., 2022). The duration of action of PBZ is between 24-48 hours (Nagelhout & Elisha, 2018). Another choice is using a selective alpha 1 receptor blocker, such as prazosin, doxazosin, and terazosin. These medications have been shown to have less post-resection hypotension (Nagelhout & Elisha, 2018).

A cardio-selective beta-blocker can control tachycardia if needed but must be used with caution. Before an alpha-blocker has time to act, administering a beta-blocker can create unopposed vasoconstriction, creating higher blood pressure but without tissue perfusion (Nagelhout & Elisha, 2018). The higher blood pressure without tissue perfusion is because blocking the beta 1 receptor will slow the heart rate and weaken inotropy (Nagelhout & Elisha, 2018).

The recommendation for best practice is to optimize the patient before surgery. If the patient is adequately hydrated and treated with alpha and/or beta-blockers preoperatively, there is a less likely risk of having labile hemodynamics intraoperatively. We have created a decision tree to help treat these hemodynamic changes if preoperative optimization does not work. Also, it is recommended to have cooling measures ready as well. Those with active pheochromocytoma are heat sensitive due to the increased basal metabolic rate; thus, cooling measures will help decrease the basal metabolic rate and the production of metabolic wastes such as carbon dioxide and potassium, which can worsen cardiovascular status.

One simple intraoperative preventative measure is to ensure a deep anesthetic level to inhibit the pheochromocytoma from releasing more catecholamines (Araujo-Castro et al., 2021). Surgical stress and tumor manipulation, as mentioned earlier, can

have profound hemodynamic effects, so blunting stimulation responses with a deepened general anesthetic can help attenuate undesired fluctuations. Blood pressure monitoring is crucial for these patients, so an arterial line or central venous access is desired (Garcia et al., 2019). In addition, a large bore IV is recommended (preferably two) to infuse both fluids and vasodilators/vasopressors (Nagelhout & Elisha, 2018). Based on literature searches for best evidence, a decision tree diagram is presented.

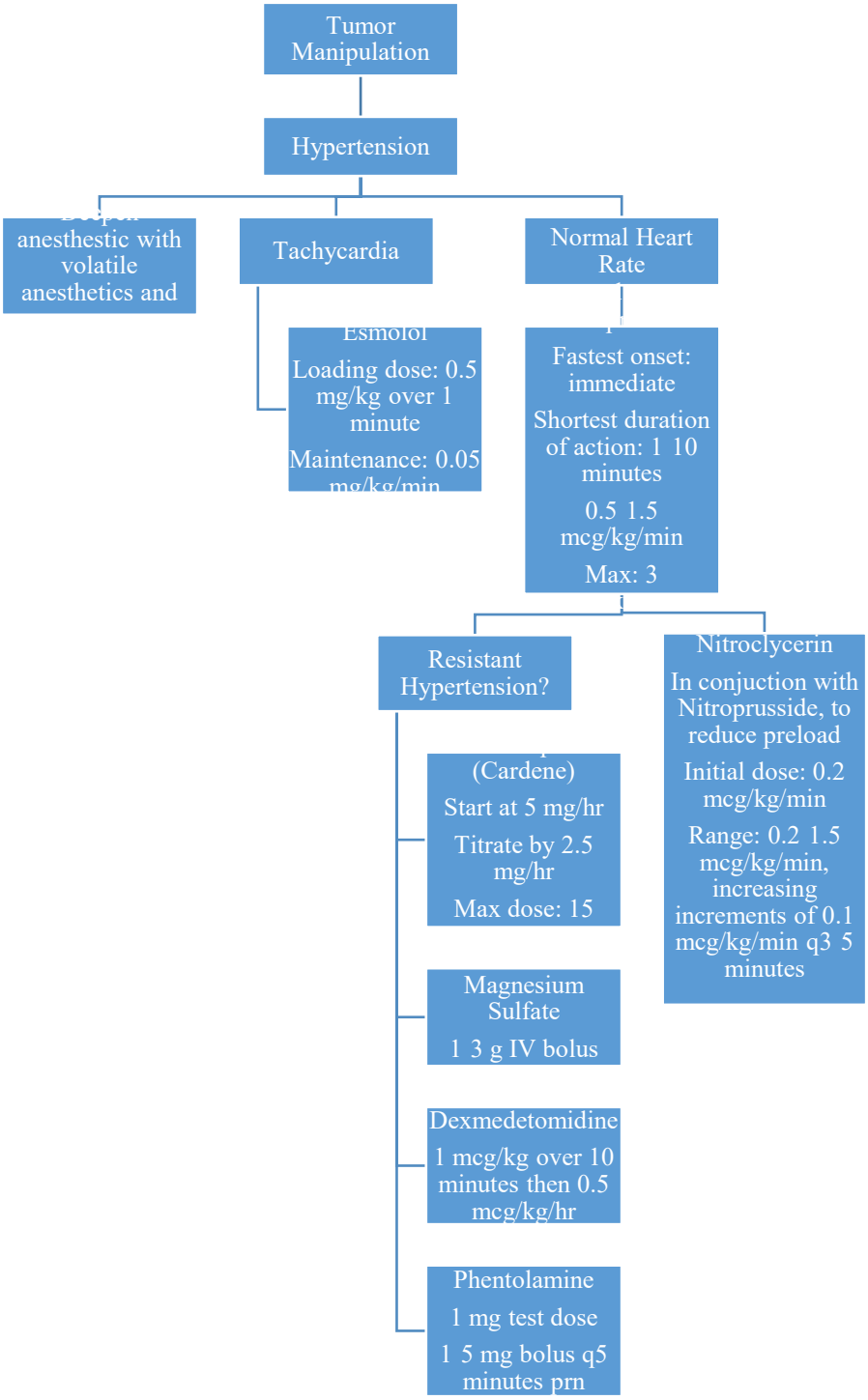


Figure 1. Tumor Manipulation

This decision tree is not intended to be an exhaustive list of treatment options, but a logical and quick first response to which a provider can manipulate as needed. The dosages included are based on Nagelhout and Elisha's 2018 Clinical Anesthesia text (Nagelhout & Elisha, 2018). Created by Daniel Attaway and Shiar Rahaim

When the surgeon creates a pneumoperitoneum for excision of the tumor, the CRNA should be ready for hemodynamic instability (Nagelhout & Elisha, 2018). Excision of the tumor will likely cause the release of catecholamines, sharply increasing blood pressure. To manage this, one of the quickest drugs to use is sodium nitroprusside. Sodium nitroprusside vasodilates both arteries and veins and is fast on and off. The property of being short on is great for preventing a further increase in blood pressure, and the fast-off property is excellent for avoiding an overshoot of pressure reduction. If there is a history or signs of heart complications, the addition of nitroglycerin can help relax coronary arteries to help with perfusion. Phentolamine is another option to use, especially if the hypertension is refractory. Phentolamine is the faster acting of the alpha antagonists. The onset of action is about three minutes and lasts about fifteen minutes (Nagelhout & Elisha, 2018).

The best used in conjunction with an alpha-blocker, a third option is nicardipine. Nicardipine is a calcium channel blocker that relaxes blood vessels and prevents the calcium-mediated release of catecholamines from the pheochromocytoma (Nagelhout & Elisha, 2018). On that note, the addition of dexmedetomidine (Precedex) can also help prevent the release of norepinephrine due to its highly selective A2 agonist properties. Magnesium sulfate is not only a natural calcium channel antagonist but also an NMDA receptors antagonist, adding an analgesic profile on board and may help add a muscle relaxant-like effect to the blood vessels (Gröber, 2019).. For best-practice hypotension treatment after tumor ligation, a decision tree is presented.

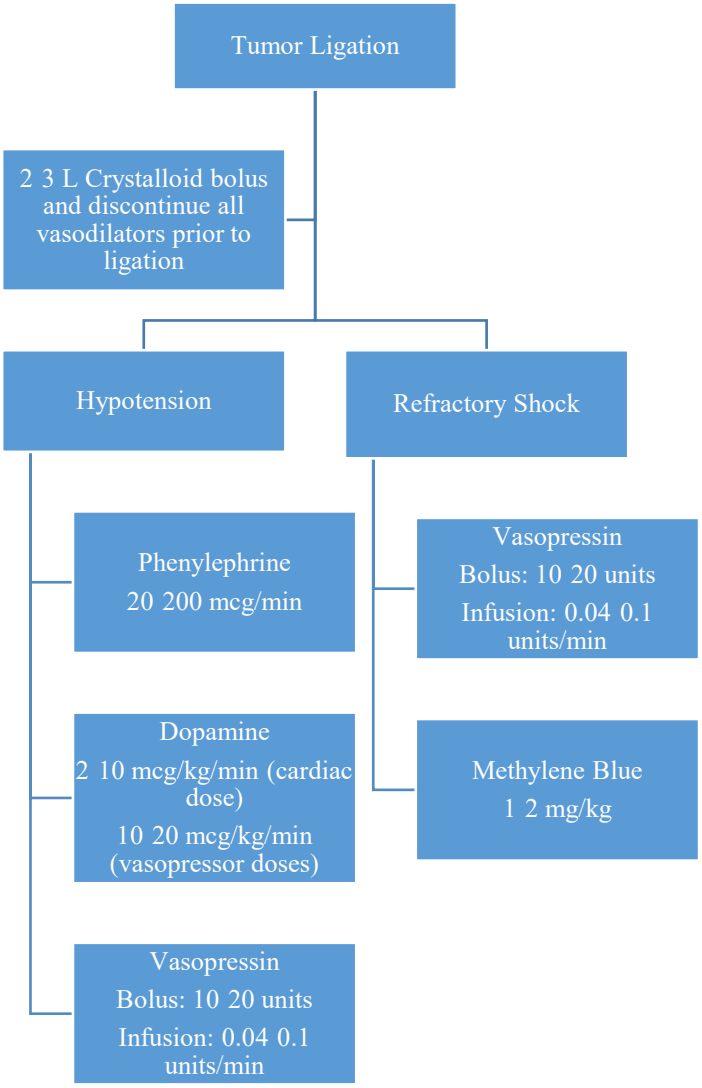


Figure 2. Tumor Ligation

This decision tree is not intended to be an exhaustive list of treatment options, but a logical and quick first response to which a provider can manipulate as needed. The dosages included are based on Nagelhout and Elisha's 2018 Clinical Anesthesia text (Nagelhout & Elisha, 2018). Created by Daniel Attaway and Shiar Rahaim

During ligation of the pheochromocytoma, persistent hypotension may ensue from the sudden decrease in catecholamines, decreased plasma volume, surgical bleeding, and anesthetic-induced vasodilation (Ramakrisha, 2015). The anesthesia provider should administer two to three liters of crystalloids and discontinue all vasodilators immediately before ligation of the pheochromocytoma to combat the

significant change in blood pressure. Hypotension should initially be treated with phenylephrine, dopamine, and vasopressin. Phenylephrine is a direct-acting alpha-agonist that increases peripheral resistance through alpha-1 stimulation and is considered a first-line treatment for hypotension due to its immediate onset (Nagelhout & Elisha, 2018). Dopamine can also be used due to its dose-dependent effect on the dopamine, beta, and alpha receptors (Nagelhout & Elisha, 2018). Lastly, vasopressin, a potent arterial vasoconstrictor, is used in septic and vasodilatory shock along with catecholamine vasopressors to increase blood pressure (Nagelhout & Elisha, 2018).

If hypotension continues and shock is suspected, the anesthesia provider should administer vasopressin and methylene blue. The use of methylene blue is not universally recommended in unstable hypotensive patients; however, its use has been shown to improve systemic vascular resistance in patients who have profound and pressor-resistant hypotension (Ramakrishna, 2015).

Doctor of Nursing Practice (DNP) Essentials

Essential I: Scientific Underpinnings for Practice

Scientific Underpinnings for Practice focuses on merging established research from multiple sources to create a compiled and legible source of information. This project has created an OSCE and a short trigger film to summarize the vast amount of available information regarding the anesthetic management of pheochromocytoma.

Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes

Interprofessional Collaboration for Improving Patient and Population Health Outcomes is the overall goal of this project. Presenting anesthetic management

techniques for pheochromocytomas in the operating room via an OSCE and a short trigger film can help reduce the morbidity and mortality of surgical patients.

Summary

Currently, there is no OSCE for the anesthetic management of pheochromocytoma. This project aims to educate on the various drugs, signs, and symptoms, and demonstrate proper management of the situation. This OSCE and short trigger film may help SRNAs and CRNAs see how a real-life pheochromocytoma crisis is handled and will hopefully be able to replicate this in real life. The time to learn and prepare for lifesaving measures is before an emergency, not during the crisis itself. Being told how to manage pheochromocytomas can be beneficial, but learning through the eyes of peers and by demonstration has better outcomes.

CHAPTER II – METHODOLOGY

The goal of this project was to demonstrate a standardized form of study that directs SRNAs on the proper anesthetic management of pheochromocytoma. Didactic levels of knowledge are the foundation of any skill set, but discrepancies between didactic and clinical understanding can hinder SRNAs' performance during their clinical practice. With the help of this OSCE, the gap between didactic and clinical-based knowledge of pheochromocytoma anesthetic management may be bridged. With this OSCE being accessible on any smart device, all SRNAs have the opportunity to see real clinical situations of anesthetic treatment of pheochromocytoma in video format. Therefore, SRNA competency in managing pheochromocytomas will be more uniform and patients will have better outcomes.

Context

This project is directed toward second-year students enrolled in the Nurse Anesthesia Program (NAP) and is open to third-year students as well. Third-year students have had more didactic training and clinical experience than second-year students, but this project can serve as a review. As of 2022, 24 registered nurses are admitted each January. Educating these students throughout their three-year journey are five experienced CRNAs. The first year consists of didactic courses, both anesthesia and research doctoral courses. Anesthesia courses are face-to-face and doctoral classes are online. Upon entering the second year of the program, SRNA's begin their two years of clinical in addition to the anesthesia and doctoral courses.

To help prepare for clinical during an SRNA's second year, most of the simulation-based learning is completed during the first year of school. Since simulation

includes all students at one time, this may be a contributing factor to SRNAs having minimal hands-on experience as they enter their second year. This OSCE may help SRNAs with a more one-on-one experience, as they can have a third-person view from the viewing screen. USM's NAP does spend time on the pathophysiology of pheochromocytoma but does not provide a step-by-step cognitive aid for action in the operating room. The second floor of Asbury Hall (College of Nursing and Health Professions, School of Leadership and Advanced Nursing Practice) provides a simulated operating room (OR) environment. The simulated ORincludes a patient dummy, an anesthesia workstation, and an anesthesia cart filled with needles, drugs, syringes, etc. With this available, an OSCE and short trigger film can provide real-life simulation of how to manage pheochromocytoma. Vital signs and other patient feedback can be manipulated by staff and/or other experienced CRNAs behind a one-way mirror to help recreate tough clinical scenarios.

The need for this project to be created is due to the observation by USM NAP faculty of SRNAs insufficiently managing pheochromocytoma patients. To correct this problem, literature searches for the best evidence were compounded, and a decision tree diagram was created. Also created was a short trigger film and an OSCE. These previously mentioned tools can become a standard learning exercise for SRNAs on anesthetic management of pheochromocytoma.

Measures

The result of this project contains current evidence-based research on anesthetic management of pheochromocytomas for USM NAP students. The OSCE/trigger video's method is to facilitate further learning for SRNAs by bridging the gap between the

didactic and clinical settings. Once the OSCE and short trigger film is completed, SRNAs should be confident in their knowledge and ability to provide safe anesthetic care to patients with pheochromocytomas, improving patient outcomes. Upon completion, surveys consisting of multiple questions regarding ease of reading, understanding, accuracy, and applicability were sent to stakeholders. Answer choices included agree, neutral, and disagree. In addition, there was a section at the end for optional open-ended feedback. The survey can be located in Appendix C and includes the following questions:

1. Do you consent to participate in the evaluation of the OSCE/trigger video for anesthetic management of pheochromocytomas?
2. Does this OSCE provide clear instructions on the anesthetic management of pheochromocytomas?
3. After participating in this OSCE, are you able to identify the possible complications during the anesthetic management of pheochromocytomas?
4. After participating in this OSCE, are you able to provide anesthetic care for pheochromocytomas?
5. In your opinion, does this OSCE include all of the necessary information to allow SRNAs to be successful in the clinical setting?
6. In your opinion, does this OSCE present all pertinent information in a structured manner to help SRNAs become successful in the clinical setting?
7. Please add any feedback that would make this OSCE easier to understand for future SRNAs

Data Collection and Analysis

After the completion of the project proposal, an evidence-based, best-practice OSCE template was created. The OSCE contains assignments, media, decision tree diagrams, and basic knowledge of the pathophysiology of pheochromocytoma and medications for anesthetic management. These must be performed, in order, by the SRNA before advancement to the next lesson. At the conclusion, there is an examination to test the newly learned skills of the SRNA. After the examination, the SRNA can review their scores and view the grading rubric for their patient scenario. To help create a real-life scenario, a trigger film of two to four minutes in length was also created. The trigger film can help provide a real-life clinical scenario to place students in a real-life-like clinical scenario and test their on-demand decision-making skills (Hartland et al., 2003).

For this project, a recruitment email, post-project survey, and online informed consent were created. Approval from the Institutional Review Board (IRB) of The University of Southern Mississippi was achieved before this project sought out the stakeholders (Protocol # 22-1221). The recruitment email was sent to sixty-eight anesthesia providers, and they were asked to review it. Of the sixty-eight recruitment emails sent, only fifteen participants responded. Stakeholders that were selected for participation include USM NAP's first-, second-, and third-year SRNAs. To serve as potential constructive critics, the five faculty members (CRNAs) of USM NAP were also included. The CRNAs included are important in verifying the correct information and offering better decision-tree solutions based on their anecdotal experience. Surveys were

provided at the completion of this OSCE which allowed for an anonymous and honest critique of the information provided.

Once all participants completed the post-test surveys were collected, the qualitative and quantitative data were assessed to ensure this project was beneficial for the SRNAs success. Through review with associated committee members and based on constructive feedback, amendments to the OSCE, decision tree, and trigger film were made as needed. Changes made based on peer feedback ensure that this project has been thoroughly vetted through multiple perspectives.

Ethical Considerations

Patient safety is arguably one of the most important ethical considerations among all individuals in health care. With the implementation of this OSCE and trigger video, SRNAs will build an understanding of pheochromocytomas and how to properly manage their anesthetic care and any ensuing cardiovascular instability should it arise, increasing overall patient safety. The methods used to create this OSCE and trigger video did not result in any direct patient contact. The survey consisted of a voluntary panel of evaluators who remained anonymous for confidentiality.

Summary

This project aimed to develop an OSCE and trigger video to meet the NAP needs at USM and provide SRNAs with knowledge and experience in the anesthetic management of pheochromocytomas. Information for this project consists of a collection of evidence-based practice (EBP), best practice guidelines, and critiques gathered from an anonymous volunteer survey. After reviewing the survey data, changes were made to improve the overall quality of the OSCE and trigger videos to better prepare students.

The organizational structure used for this project meets the American Association of Colleges of Nursing (AACN) DNP essentials and USM College of Nursing and Health Professions standards.

CHAPTER III – RESULTS

Steps and Analysis

The purpose of this DNP project is to create a real-life, hands-on educational experience for current or future students and staff to properly recognize and manage a patient with pheochromocytoma in the clinical setting. The structure and sources of this OSCE template are built using up-to-date evidence-based practice. Surveys were completed by all levels of anesthesia providers at The University of Southern Mississippi. The voluntary participation emails sent to anesthesia providers included the following: Informed consent, OSCE template, and the link to the Qualtrics™ survey. CRNAs for the NAP of USM were the evaluating committee. The results are 100% anonymous and are intended to benefit anesthesia providers alike in unmasking their weakness in the topic of pheochromocytoma. All listed survey results are from those who answer "yes" to informed consent. The eight survey results are listed and explained below.

Question 1

Do you agree to the standard online informed consent to participate in this study? Yes/ No, If no, you may not proceed with the survey.

Answer Choices and Responses

Yes- 15

No- 0

This question confirms that participants willfully and voluntarily desire to complete this survey.

Question 2

Does this OSCE provide clear instructions on the anesthetic management of pheochromocytomas?

Answer Choices and Responses

- Yes- 15
- No- 0
- Maybe- 0

Question 3

If you selected no or maybe, please explain what would have made it clearer and anything that was omitted: _____.

Answer Choices and Responses

- Responses- 0

Question 4

From the following list, please select 3 potential complications that occur as a result of a pheochromocytoma. (Select 3)

Answer Choices and Responses

- Hypotension
- Hypertension- 15
- Hyperthermia-15
- Hypothermia
- Tachycardia-15
- Respiratory Depression

The results of this question show a clear understanding of the clinical signs of pheochromocytoma after viewing the OSCE.

Question 5

After reviewing the OSCE information and the video, using a scale of 0 (not at all) to 7 (absolutely), please rate your confidence in the anesthetic management of a pheochromocytoma.

Answer Choices and Responses

- 0
- 1
- 2
- 3
- 4
- 5 – 1
- 6 – 1
- 7 - 13

This question indicates that there is still some room for improvement on the OSCE, but overall it is sufficient to teach students.

Question 6

Do you feel this OSCE will help you to be successful in identifying a pheochromocytoma patient crisis in the operating room?

Answer Choices and Responses

- Yes- 15
- No- 0

Recognition of pheochromocytoma is critical to the treatment of signs/symptoms, and this question confirms the confidence in the student's ability.

Question 7

If you answered No please tell us what you would have liked to be included.

- Responses- 0

Question 8 (Feedback)

Please add any additional information or feedback to make this OSCE more beneficial for student use.

- "The videos and cognitive aid are very helpful. Thanks!"

Summary

This OSCE is presented and intended to fill the gap between didactic knowledge and clinical application for the management of pheochromocytoma. Pheochromocytomas are uncommon enough to create the aforementioned didactic or clinical knowledge gap. The cognitive aid presented in Chapter II has proven itself as a useful tool per the survey results of anesthesia providers at USM. For a quick reference or reminder, we recommend a laminated printout of the cognitive aid to be placed somewhere in the operating room, whether that be on top of the anesthesia cart, on the side of the anesthesia cart, or on the wall behind where the anesthesia provider sits during surgery.

CHAPTER IV – DISCUSSION

This DNP project is intended to further strengthen the curriculum of the NAP at USM. A strong learning experience is created by incorporating a real-life scenario of vital sign changes and appropriate drugs to use. All data used to create the recommended practice guidelines and cognitive aid is current and backed by evidence-based practice in addition to meeting the AACN DNP essentials.

Survey results from participants were anonymous and provided positive feedback on the efficacy of the OSCE. Based on the results, anesthesia providers believe that they are now better prepared to recognize the uncommon pheochromocytoma and are better able to clinically manage its signs/symptoms. Although the survey results are acceptable for OSCE publication, the results still give insight into the room for improvement, which can be a future DNP project. Overall, providers responded that they are better equipped both didactically and clinically to handle a sudden pheochromocytoma case.

Future considerations for another DNP project are the development of this OSCE into a live simulation experience. One group could be given the cognitive aid and the OSCE while the other group should only be allowed to view the OSCE. This can show the relevance of viewing a peer perform clinical actions and judgments versus only reading about them on paper to see how effective each is separately and why they should be combined. A written post-test can prove the effectiveness of the visualization and performance of pheochromocytoma management.

Interpretations

Survey results show that providers overall are better prepared for clinical management of pheochromocytoma after studying the cognitive aid and viewing the

OSCE video. Anesthesia providers now have benefitted from this project by improving their adrenergic receptor, catecholamine, drugs, and receptor knowledge. Based on the survey results, participants are more competent not only in clinical practice but also in their ability to use didactic knowledge to back up their clinical performance when treating pheochromocytoma.

Limitations

Although this DNP project has proven to be beneficial, there are some limitations to the study. The first is that of sample size. The survey invitation was sent to sixty-five anesthesia providers and only fifteen responded. While this is a twenty-three percent response rate and considered above average, a higher response rate would have likely yielded more information The reason for a lower-than-expected response rate could possibly have been timing with scheduling. Clinical practice days can be greater than ten to twelve hours for the subjects who participated and may have impeded responses. Another limitation is that the survey was only sent to anesthesia providers at one site. This could lead to the possibility of participant bias, leaning toward favoritism toward the facility. For future improvement on this project, providers from multiple sites could help assess knowledge related to pheochromocytoma. Assessing student perspectives from different schools can help assess the knowledge base of pheochromocytoma of USM students; Use of the OSCEs at one facility versus training at other facilities may advantage one group over another and this would be visible in the data analysis.

Conclusion

A request has been submitted for this project to be reviewed and possibly entered into USM's OSCE library. If accepted and integrated, this OSCE will also be a resource

for future students at other anesthesia schools across the country. Sharing this OSCE with students nationwide can not only bring light to the preparation and expertise that USM students are receiving during their three-year tenure but also help all anesthesia providers be on the same page when managing a tumor so rare but often so difficult to control.

APPENDIX A – OSCE Script

An Objective Structured Clinical Examination for Anesthetic Management of Pheochromocytoma

ANESTHESIA OBJECTIVE STRUCTURED CLINICAL EXAM

TITLE OF OSCE HERE

LEARNER OUTCOMES: (What are the students going to take away from this OSCE?)

1. Proper use of vasoactive drugs
2. Identify and treat signs and symptoms of pheochromocytoma
3. Identify signs/symptoms of pheochromocytoma
   Treat signs/symptoms of pheochromocytoma
   Use/locate cognitive aid for algorhythm decision making

DOMAINS: (Select up to 3)

Assessment – Pre/intra/post op	Evaluation of teaching
Consent	Formative evaluation - feedback
Communication	Interprofessional collaboration
Clinical skill	Performance assessment
Critical thinking	Progression evaluation
Didactic knowledge	Summative evaluation

PURPOSE: to identify and treat the likely lethal symptoms of pheochromocytoma

LEARNER OBJECTIVES: (These are based on knowledge required to meet the outcomes) Using Bloom's Taxonomy

1. Identify __signs/symptoms _____
2. Demonstrate__clinical judgement____
3. Appropriately ____administer vasoactive drugs_____

INDIVIDUAL OR GROUP OSCE: Individual

REQUIRED READING and ASSOCIATED LECTURES:

1. Nagelhout 6th edition, chapter 37

REQUIRED VIDEO: Link to Pheochromocytoma video

https://drive.google.com/file/d/1dB2xmtsBnDCKzevNqfcM26r2msH8p3so/view?usp=share_link

Link to Trigger Film video

https://drive.google.com/file/d/1N9gckrNw0G4GoGHiOsiQLn22psJebvtl/view?usp=share_link

An Objective Structured Clinical Examination for Anesthetic Management of Pheochromocytoma

REQUIRED PARTICIPANTS: Volunteer student

VENUE: Sim Lab

STUDENT LEVEL OF OSCE: Semester 1-2, 3-4, 5-6, 7-9

TIME ALLOTED: 15 minutes

SEQUENTIAL PRACTICE & TESTING: Knowledge evaluation

RECOMMENDED PRACTICE PRIOR TO EXAMINATION: 3x recommended, 15 minutes each time

CONTEXT: (Background/story)

CONTENT OUTLINE

You are assigned to a patient with a history of pheochromocytoma. This patient is here for removal of pheochromocytoma. You check this patient's labs and vitals prior to surgery, and prepare vasoactive drugs per the cognitive aid provided. Surgery starts, and you use the pertinent drugs based on which pathway the vital signs take you down the algorithm of the cognitive aid.

EQUIPMENT& SUPPLIES:
Fluid bags, tubing, iv supplies, tape, vasoactive drugs on standby as listed per cognitive aid

SITE SELECTION:
N/A

TASK STATEMENT:
Identify signs/symptoms of pheochromocytoma, treat appropriately per the correct algorithmic pathway.

PROCESS
Is there tachycardia or bradycardia? Go down the correct pathway. Is there hypotension after tumor resection? Respond accordingly via the correct pathway.

IMAGES:

An Objective Structured Clinical Examination for Anesthetic Management of Pheochromocytoma

REQUIRED PARTICIPANTS: Volunteer student

VENUE: Sim Lab

STUDENT LEVEL OF OSCE: Semester 1-2, 3-4, 5-6, 7-9

TIME ALLOTED: 15 minutes

SEQUENTIAL PRACTICE & TESTING: Knowledge evaluation

RECOMMENDED PRACTICE PRIOR TO EXAMINATION: 3x recommended, 15 minutes each time

CONTEXT: (Background/story)

CONTENT OUTLINE

You are assigned to a patient with a history of pheochromocytoma. This patient is here for removal of pheochromocytoma. You check this patient's labs and vitals prior to surgery, and prepare vasoactive drugs per the cognitive aid provided. Surgery starts, and you use the pertinent drugs based on which pathway the vital signs take you down the algorithm of the cognitive aid.

EQUIPMENT& SUPPLIES:
Fluid bags, tubing, iv supplies, tape, vasoactive drugs on standby as listed per cognitive aid

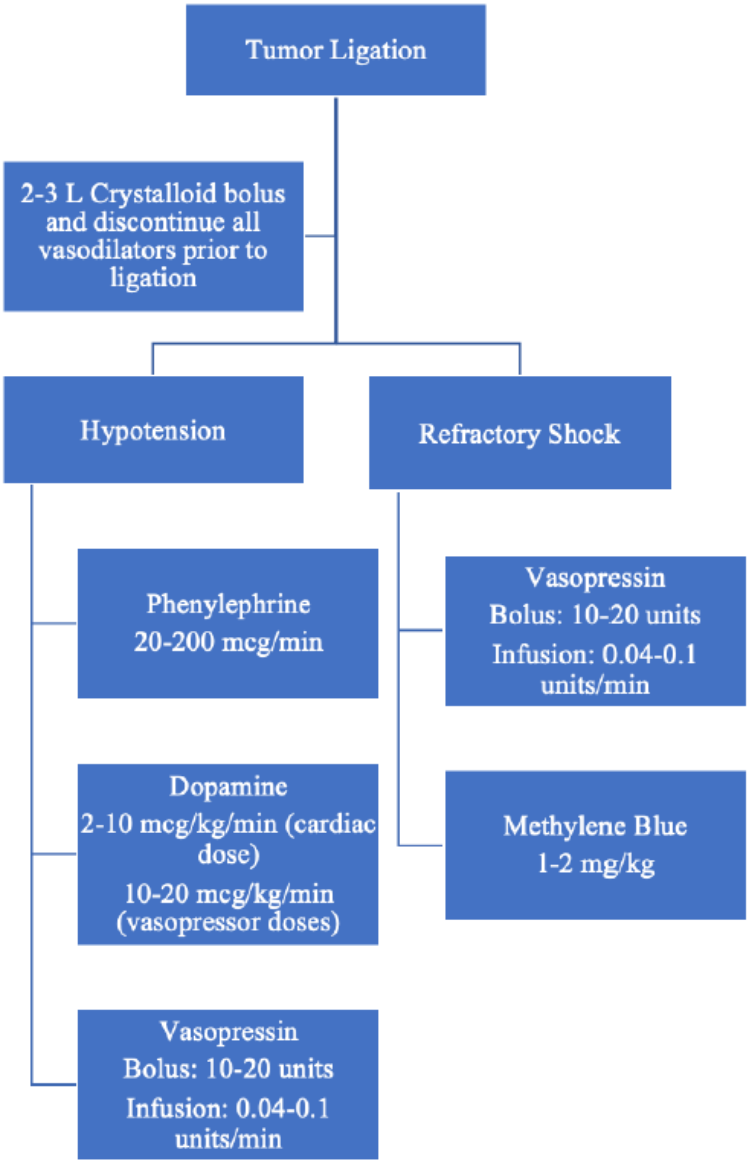
SITE SELECTION:
N/A

TASK STATEMENT:
Identify signs/symptoms of pheochromocytoma, treat appropriately per the correct algorithmic pathway.

PROCESS
Is there tachycardia or bradycardia? Go down the correct pathway. Is there hypotension after tumor resection? Respond accordingly via the correct pathway.

IMAGES:

An Objective Structured Clinical Examination for Anesthetic Management of Pheochromocytoma



DEBRIEFING FORM:
On a scale from 0-10, how likely are you to recommend this OSCE to a fellow SRNA/CRNA?
1 2 3 4 5 6 7 8 9 10

The OSCE performed by the student demonstrates foundational knowledge and skill of Pheochromocytoma management (circle one)

An Objective Structured Clinical Examination for Anesthetic Management of Pheochromocytoma

Pass Fail

Does the student need to repeat this OSCE to satisfy learning requirements?

Yes No

ASSESSMENT

Rubric for Clinical Management of Pheochromocytoma

(Here are where you take your "process" and make it into exact steps you are evaluating)

QUESTION & DEMONSTRATION STATION:

	TASKS	PASS	FAIL	COMMENTS
	1. Prepares and selects appropriate equipment			
*	2. Selects appropriate site for IV start utilizing ultrasonography			
*	3. Demonstrates proper use of ultrasound machinery			

*	4. Identifies layers and structures appropriately on image provided			
*	5. Identifies compressible vessel to puncture			
	6. Identifies layers and structures appropriately on live OSCE patient			
	7. Demonstrates proper angle of angiocath for skin puncture			
*	8. Demonstrates proper securing of IV after placed			
	9. Appropriately cleans machinery and stores			
	10. Re-evaluates patency of IV			

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

The OSCE by the student demonstrates foundational knowledge and correct use of the ultrasound machine in obtaining IV access: (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 B – IRB Approval Letter

Office *of*
Research Integrity

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

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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:	22-1221
PROJECT TITLE:	An Objective Structured Clinical Examination for Anesthetic Management of Pheochromocytoma
SCHOOL/PROGRAM	Leadership & Advanced Nursing
RESEARCHERS:	PI: Daniel Attaway Investigators: Attaway, Daniel~Rahaim, Shlar~Mclain, Nina Elisabeth~
IRB COMMITTEE ACTION:	Approved
CATEGORY:	Expedited Category
PERIOD OF APPROVAL:	05-Dec-2022 to 04-Dec-2023

Donald Sacco Jr.

Donald Sacco, Ph.D.
Institutional Review Board Chairperson

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