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Point of Care Ultrasound for the Diagnosis of a Pneumothorax: An Objective Structured Clinical Examination

Shelby Dye

Hannah Fortenberry

POINT OF CARE ULTRASOUND FOR THE DIAGNOSIS OF A PNEUMOTHORAX: AN OBJECTIVE STRUCTURED CLINICAL EXAMINATION

by

Shelby Dye and Hannah Fortenberry

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Approved by:

Dr. Nina McLain, Committee Chair
Dr. Stephanie Parks
Dr. Michong Rayborn

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ABSTRACT

A pneumothorax is a complication that can result from skills performed by anesthesia providers. Prompt recognition can be achieved by the use of an ultrasound and can potentially improve patient outcomes. At The University of Southern Mississippi's (USM) Nurse Anesthesia Program (NAP), no current objective structured clinical examination (OSCE) for detecting a pneumothorax by point of care ultrasound (POCUS) exists. USM's NAP recognized the need for an evidence-based OSCE for the detection of pneumothorax with POCUS. The gap in knowledge prompted the development of the demonstrational video and OSCE template to potentially increase student confidence in the clinical setting.

The OSCE template, video, and best practice guidelines were developed using evidence-based research. A survey was sent to certified registered nurse anesthetists (CRNA) at USM-affiliated clinical sites, first, second, and third-year student registered nurse anesthetists (SRNA), and NAP faculty. The participants were provided with a consent form, the OSCE template, a video, and a questionnaire. Of the 45 responses, the quantitative and qualitative data concluded that all participants agreed that the OSCE could potentially increase student confidence. Based on the results of the survey, the authors recommend that the OSCE be incorporated into the USM NAP curriculum.

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We want to thank our original committee chair, Dr. Stephanie Parks, for her encouragement to us throughout the completion of this doctoral project and also for her dedication and service to our country. We also would like to thank Dr. Nina McLain for stepping in as our committee chair as Dr. Parks serves our country. She has given us excellent guidance and support as we have completed this doctoral project. Finally, we would also like to thank Dr. Michong Rayborn for serving as our committee member throughout this doctoral project.

DEDICATION

I want to thank God, through which all things are possible. I would also like to thank my husband for his constant support, encouragement, and selflessness throughout this doctoral project's creation and the program's duration. I would also like to thank my parents and my brother. They have each individually given me opportunities to achieve my goals and made me who I am today. *Shelby Dye*

I would like to dedicate the completion of this doctoral project to my mother, who, before she passed, urged me to follow my dreams of becoming a CRNA. Her encouragement, push, and support led me to pursue this journey. A special thank you to my husband for his unwavering support and reassurance throughout this process. I would also like to thank my family and friends for their unconditional love, support, and patience. Without the love and support, I would not be here today, and I hope to make you all proud. *Hannah Fortenberry*

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LIST OF ABBREVIATIONS

COA	Council on Accreditation
CRNA	Certified Registered Nurse Anesthetist
CT	Chest Computed Tomography
CVC	Central Venous Catheter
CXR	Chest X-ray
DNP	Doctor of Nursing Practice
OSCE	Objective Structured Clinical Examination
POCUS	Point of Care Ultrasound
SRNA	Student Registered Nurse Anesthetist
USM	The University of Southern Mississippi

CHAPTER I - INTRODUCTION

Point-of-care ultrasound (POCUS) is a practice that is rapidly gaining popularity among various healthcare providers, especially certified registered nurse anesthetists (CRNAs) and anesthesiologists. POCUS, ultrasonography at the patient's bedside, allows the anesthesia provider to perform essential tasks such as peripheral nerve blocks, central line insertions, preoperative anesthetic evaluation of gastric content, and diagnosing cardiovascular and pulmonary pathology. Though historically, these tasks have been performed without POCUS, Brumfield (2021) notes that learning the POCUS skillset as an anesthesia provider is shown to heighten clinical skills, improve confidence, and enhance the clinical decision-making of the provider.

As an anesthesia provider, the CRNA must have the clinical skill and confidence to ensure quality patient care. The millions of surgeries occurring each year worldwide bring along patients with multiple comorbidities such as heart disease or trauma patients that may present with complications such as a pneumothorax that can alter the CRNA's typical day-to-day practice. These problematic situations may require the CRNA to utilize equipment to ensure patient safety, such as POCUS. POCUS offers "immediate answers to diagnostic questions while avoiding harmful radiation exposure and reducing healthcare costs across clinical contexts and practice setting" (Singh et al., 2022, p. 1). Thus, CRNAs or those training to be CRNAs should be confident in using POCUS to ensure provider success and quality patient care.

Problem Description

POCUS is a safe and efficient diagnostic and procedural tool commonly used in surgical settings. However, there is a lack of standardized POCUS curricula at The

University of Southern Mississippi (USM), thus leading to a failure to learn the fundamentals of POCUS as a student registered nurse anesthetist (SRNA). A failure to learn the fundamentals leads to decreased student success and negatively impacts patient care (Singh et al., 2022).

Background of the Problem

The University of Southern Mississippi's Nurse Anesthesia Program (NAP) provides an intensive didactic and clinical experience for students preparing to become CRNA. The required didactic and clinical hours are necessary to evolve the SRNA's skill and knowledge to perform exceptional patient care. Subsequently, having a standardized assessment method for the clinical skills the SRNA learns could be advantageous for USM's NAP and the SRNA. Mitchell et al. (2018) note that though clinical examinations test didactic knowledge, a specific training program can assess mastery of clinical skills. According to Majumder et al. (2019), an Objective Structured Clinical Examination (OSCE) universally remains the gold standard for evaluating the clinical competence of students of other specialties. OSCEs have been adopted widely among several undergraduate and postgraduate programs and can offer a solution to help assess the fundamentals of clinical knowledge among nurse anesthesia programs. In addition, incorporating OSCEs could potentially help provide a valid and reliable method to assess clinical competencies among SRNAs.

As mentioned, didactic knowledge is tested through examinations, presentations, and papers. USM evaluates clinical skill and expertise through formative and summative evaluations completed by clinical preceptors. However, there is no current evaluation for a specific skill, such as POCUS use, to assess the competency of the SRNA. With this

rising use of POCUS in the clinical setting, incorporating an OSCE for detecting a pneumothorax with POCUS into the curriculum could increase student and program success. The three-year program includes 114 semester hours with two years of clinical practice (Nurse Anesthesia Program [NAP], 2021). Within the 114 semester hours, courses such as NUR 855, Clinical Correlation in Anesthesia, and NUR 840, Principles of Anesthesia Practice II, could utilize the OSCE (NAP, 2021). The Policy and Procedural Manual for USM's NAP suggests that NUR 855 focuses on "using simulation and hands-on practice to develop the necessary skills for a career in anesthesia" (NAP, 2021, p. 26), while NUR 840 builds on the fundamentals of anesthesia such as acute and chronic pain management. Thus, integrating the use of POCUS when learning about regional anesthesia could enhance the student's success.

Statement of the Problem

The Council on Accreditation of Nurse Anesthesia Education Programs (COA) requires simulation for nurse anesthesia programs because of the benefits and confidence it brings students (Staun et al., 2020). A specific and evidence-based POCUS simulation can benefit the SRNA before clinical rotations. Though the use of POCUS encompasses a wide scope in the anesthesia world, for the purpose of this doctoral project, the OSCE will focus on POCUS as it relates to the evaluation of pneumothorax. At The University of Southern Mississippi's Nurse Anesthesia Program, no current objective structured clinical examination of POCUS to diagnose a pneumothorax exists. Without a standardized clinical evaluation on SRNAs diagnosing a pneumothorax with POCUS, it could potentially lead to poor clinical performance by the SRNA, possibly leading to decreased patient quality care and educational experience for the student. Therefore, an

evidence-based, objective structured clinical examination will be established to help prepare the SRNA for success in utilizing POCUS when entering a clinical rotation.

Significance of the Problem

This doctoral project aims to create an OSCE to teach SRNAs in the NAP at USM to diagnose a pneumothorax using POCUS. Creating an OSCE on POCUS use is a step-by-step process for adequately navigating the POCUS machine relating to diagnostic and procedural clinical skills. The lack of a standardized assessment method could lead to the SRNA's inability to utilize POCUS in the clinical setting, potentially decreasing student confidence and delaying patient care. In addition*, Point-of-care ultrasound device market demand forecast for 2030* (2021) suspects POCUS has a compound annual growth rate of 7.9% from 2021 to 2030. Thus, the importance of the anesthesia provider knowing how and when to use POCUS is of utmost importance.

Anesthesia providers perform various skills such as peripheral nerve blocks, procedures such as peripheral line insertion or central line insertion, and ventilator management. Though providers undergo training, certain complications are associated with these skills, one of which is a pneumothorax. Smit et al. (2018) and Hsu and Sun (2014) note that some common causes of an iatrogenic pneumothorax are central line insertion, regional blocks such as supraclavicular and interscalene blocks, barotrauma, and high peep. Thus, the anesthesia provider needs to be able to quickly and efficiently use POCUS to determine whether a pneumothorax is present. According to Zayyan (2011), students who undergo an OSCE often have dependable adaptability that allows the "reproduction of a wide range of clinical phenomena tailored to the student's level of skill" (p. 3). As a result, incorporating a standardized evaluation method, such as an

OSCE, for SRNAs to properly use POCUS and determine whether the patient has a pneumothorax could lead to better student preparedness for clinical rotations, thus potentially leading to efficient patient care.

Available Knowledge

Point-of-Care Ultrasound Characteristics

Though POCUS is utilized in various healthcare-related fields for countless procedures and assessments, the initial step in operating a POCUS is to understand the machine's science and different parts. Some critical factors associated with understanding an ultrasound machine are echogenicity, beam properties, the Doppler mode, probe selection, image production and interpretation, and scanning techniques for needle visualization (Kline, 2021). The basic science of ultrasound is based on the piezoelectric effect. Manwar et al. (2020) describe this effect as the idea of the ultrasound probe utilizing piezoelectric material to convert electrical energy into acoustic energy. Subsequently, when an electrical current is applied to the piezoelectrical material, vibration occurs, allowing the radiation of ultrasonic sound waves. All sound waves can be explained by seven characteristics which are as follows: “period, frequency, propagation speed, amplitude, power, intensity, and wavelength” (Kline, 2021, p. 36). Understanding the science and these characteristics allow the user, such as an SRNA, to manipulate the ultrasound probe to enhance the image. The basic pathophysiology of ultrasound is that the ultrasound probe emits waves that pass-through tissue in which targeted structures absorb and send reflected waves, which produce an image (Kline, 2021).

Kline (2021) defines echogenicity as a structure's ability to absorb or reflect ultrasound waves. When using ultrasound, it is imperative to understand the difference between hypoechoic and hyperechoic images to determine the difference between bone, needle, tissue, etc. Upon scanning a patient, the POCUS will show black-and-white images. The white images are hyperechoic and typically reflect dense structures such as bone or needles. In contrast, black images are known to be hypoechoic and typically reflect fluid or air-filled spaces (Kline, 2021). Van de Berg et al. (2019) states that the inability to locate the needle leads to 70% of ultrasound intervention complications; thus, understanding the appearance of the needle is crucial for SRNA success.

One crucial part of the ultrasound is the probe, also known as the transducer. The primary purpose of an ultrasound transducer is to convert waves into electrical signals (Manwar et al., 2020). The hourglass-shaped beams that the transducer emits are comprised of different zones. Closest to the transducer is the Fresnel zone. The beam then condenses in the middle, producing the highest focal zone in which the image quality is the highest. The most distal zone is the Fraunhofer zone (Kline, 2021). The importance of the zones reflects image production due to the probe's selection being dependent on the depth of the targeted structure. For instance, the farther the structure from the surface of the probe, the more diminished the reflection of sound waves (Kline, 2021). Manwar et al. (2020) note several different probe options, with the most common probes being the piezoelectric linear, curvilinear, and phased array. Liner transducers are known for their ability to identify superficial structures. In contrast, the curvilinear and the phased array are known for identifying deep structures with a wide field of view; however, the phased array has "a small footprint enabling imaging through the intercostal rib spaces better

than a curved probe" (Kline, 2021, p. 39). Having insight into the proper probe for task at hand leads to the success of the SRNA.

Scanning Technique and Needle Visualization

After understanding the basics of ultrasound science, and the logistics of different transducer options, the SRNA must understand and demonstrate the appropriate scanning technique for needle visualization. The first step in ultrasound use is image production. After identifying the targeted structure's general location, the user must maintain a steady probe to ensure a clear, readable image. To ensure a steady probe, Kline (2021) recommends placing part of the hand holding the probe on the patient's body. This act of hand stabilization aids in movement with the patient rather than losing the view if the patient were to move. With an adequate amount of ultrasound gel and appropriate, steady probe placement, the SRNA must interpret the image. POCUS has multiple imaging tools, such as Doppler, change in depth, and midline markers, to assist in locating landmarks, and obtaining a high-quality image (Baribeau et al., 2020).

The use of POCUS in anesthesia often involves needle placement. Out-of-plane and in-plane techniques are two ways to locate a needle on the ultrasound. Popular for vascular access, the out-of-plane technique consists in inserting the needle in the center of the front of the probe once the desired image is located and "advancing the probe slightly ahead of the needle tip, and repeatedly backing the beam up to find it" (Kline, 2021, p. 41). On the contrary, the in-plane technique is when the needle is inserted from the side of the probe face leading to a narrow range of needle visualization (Kline, 2021). Regardless of the techniques, needle visibility can be affected by complications such as poor needle echogenicity, difficulty with alignment, and artifacts (Van de Berg et al.,

2019). As an anesthetist, it is essential to maintain needle visualization to ensure appropriate direction to the target. Van de Berg et al. (2019) note that enhancing visibility techniques can augment needle visualization. POCUS has adjustments that allow for better visualization. These adjustments include changing the depth, brightness, contrast, and gain (Kline, 2021). Though simple to the naked eye, POCUS is an advanced tool used by anesthetists to aid in various diagnoses and perform multiple procedures.

Pneumothorax Detection

Although POCUS can be used for a variety of medical examinations, for the purpose of this doctoral project, the authors have decided to focus on the use of POCUS in detecting a pneumothorax. Detection of a pneumothorax was chosen because of its occurrence with anesthesia-related practices such as Central Venous Catheter (CVC) placement, mechanical ventilation, and various regional nerve blocks. Tsotsolis et al. (2015) state that pneumothoraces are responsible for roughly 30% of the mechanical complications associated with CVC placement. Today, the gold standard for diagnosing a pneumothorax is with a Chest X-Ray (CXR) (Smit et al., 2018). However, the addition of POCUS to determine whether or not a pneumothorax is present may save time, money, and improve patient outcomes (Koh et al., 2022).

Before understanding how POCUS can impact the diagnosis of a pneumothorax, it is crucial that the SRNA or CRNA understand how to use a POCUS machine, the signs and symptoms of a pneumothorax, and what a pneumothorax looks like via ultrasound. Signs and symptoms of pneumothorax while being mechanically ventilated include, but are not limited to, tracheal deviation, decreased breath sounds on the affected side, decreased blood pressure, decreased tidal volume, and an increase in airway pressure

(Hsu & Sun, 2015). A pneumothorax is confirmed by the absence of lung sliding with inspiration and expiration on the image produced by the ultrasound (Baid et al., 2022). Lung sliding is detected by the congruity of the visceral pleura and parietal pleura (Koh et al., 2022). When these layers are separated by air, the lung sliding is absent, thus being a diagnostic characteristic of a pneumothorax (Koh et al., 2022).

Regarding anatomical location, most pneumothoraces are found anteriorly while the patient is in the supine position, thus making the intercostal space between the 2nd and 3rd rib below the midclavicular line a promising location for pneumothorax detection (Koh et al., 2022). Another diagnostic marker used to confirm the presence or absence of a pneumothorax is the seashore sign. This sign is present in the normal lung when the M mode marker on the POCUS is centered on the pleural line (Lewis, 2019). In contrast, in a pneumothorax, when the M mode marker on the POCUS is centered on the pleural line, a barcode-like appearance will be present instead of the seashore sign (Lewis, 2019).

Smit et al. (2018) state that upwards of 5 million CVCs are placed each year in the United States. Because CVC placement is a common procedure and is within the scope of practice for the CRNA, the CRNA must be well aware of the potential for this procedure to cause a pneumothorax. As of now, the gold standard for determining whether or not a CVC has caused a pneumothorax is obtaining a CXR (Smit et al., 2018). However, Smit et al.'s (2018) systematic review, found that using POCUS to identify a pneumothorax yielded much faster results than obtaining a CXR and eliminated the risk of radiation exposure to the patient.

In regard to detecting a pneumothorax in a trauma patient, Tsotlosis et al. (2015) state that ultrasound was not only more sensitive in detecting a pneumothorax than a

supine CXR but also just as sensitive in detecting a pneumothorax as a Chest Computed Tomography (CT) Scan. Tsotlosis et al. (2015) also discuss how multiple other studies in the researchers' systematic review show that using a thorough ultrasound examination has resulted in close to 100% sensitivity and up to 95% specificity in diagnosing a pneumothorax. Using an ultrasound to diagnose a pneumothorax in trauma patients also eliminates having to move a potentially unstable patient to a different area of the hospital and allows the patient to remain in their original monitored environment (Tsotlosis et al., 2015).

In regard to pneumothoraces caused by various regional blocks, the prevalence of pneumothoraces that occur from accidental pleural puncture while performing peripheral nerve blocks, such as a supraclavicular block, has decreased since ultrasound usage has become more prevalent than the landmark technique (D'Souza & Johnson, 2022). Furthermore, a prospective observational study conducted by Gauss et al. (2014), showed that over the course of eight years, only four patients had a symptomatic pneumothorax with ultrasound guidance when receiving an infraclavicular or supraclavicular block. In comparison, utilization of the landmark technique when performing a supraclavicular block had a pneumothorax rate of 6.1% (Gauss et al., 2014). Therefore, though the incidence of pneumothoraces are low with ultrasound guidance peripheral nerve blocks because both ultrasound-guided peripheral nerve blocks and the utilization of landmarks to perform peripheral nerve blocks are skills expected of the SRNA, recognizing when a pneumothorax has developed and understanding how to detect a pneumothorax with ultrasound will be a useful skill to have for the SRNAs anesthesia practice.

Objective Structured Clinical Examination

An OSCE or an Objective Structured Clinical Examination is an examination format developed in 1975 as an alternative to the often-criticized clinical examination known to have low psychometric qualities (Onwudiegwu, 2018). Traditionally, an OSCE is a timed clinical examination comprising 10 to 25 stations, each lasting 5-20 minutes, encompassing tasks such as history taking, physical examination, case summaries, procedural skills, etc. (Onwudiegwu, 2018). Onwudiegwu (2018) mentions that an OSCE differs from the traditional clinical examination because it allows the student to demonstrate their ability without interruption from the examiner, therefore allowing adequate assessment of the OSCE topic. Harden et al. created the OSCE to provide a more reliable and valid assessment evaluation (Tseng et al., 2021). Harden et al. (2016) categorize eight components of an OSCE, which consist of "performance assessment; process and product; profile of learner; public assessment; participation of staff; pressure for change with poor overall class performance" (Harden et al., 2016, p. 9). As OSCEs have developed throughout the years, many undergraduate and graduate programs have started incorporating structured clinical examinations as formative and summative evaluations. These evaluations reflect the challenges of the teaching process and provide an avenue to support learning in the future (Tseng et al., 2021).

As mentioned previously, the COA recommends simulation for NAPs due to the benefits and confidence it brings students (Staun et al., 2020). Though there are many clinical evaluation tools for graduate programs, Onwudiegwu (2018) notes that incorporating an OSCE encourages student confidence, increased preparedness for clinical, meaningful learning, and provides a platform for student feedback. By allowing

student feedback, an OSCE increases the student success who is presenting and those watching. The development of the OSCE format will enable programs to incorporate a quality, objective, standardized clinical evaluation tool to ensure student competency and satisfaction in clinical rotations.

Rationale

The use of POCUS is rapidly rising among healthcare professionals, and for a good reason. POCUS is safe, cost-effective, and often brings diagnostic answers faster than traditional exams (Singh et al., 2022). However, standardized POCUS education is lacking (Singh et al., 2022). An OSCE is an excellent tool the SRNA can utilize to incorporate the knowledge gained in the classroom and practice it in a simulated setting (Tseng et al., 2021). In addition, the SRNA may be presented with an opportunity to use a POCUS to diagnose a pneumothorax if a pneumothorax is suspected in a clinical setting. Therefore, an OSCE should be made available to SRNAs so that they will be prepared if such a situation were to occur. The OSCE could provide confidence and education and improve motor skills for using POCUS. This OSCE could ultimately lead to improved clinical performance by the SRNA and a higher quality of care for patients.

Frameworks and Theories

This doctoral project is designed to aid in SRNAs' preparedness and education regarding the use of POCUS for the detection of pneumothorax. Developing a POCUS for detecting a pneumothorax OSCE enables instructors to assess the student's psychomotor skills, whereas a traditional examination could not (Onwudiegwu, 2018). That is why the OSCE method was chosen for the framework of this doctoral project. OSCEs have been utilized to provide constructive feedback, assess students'

preparedness, and enhance critical thinking (Kelly et al., 2016). OSCEs can consist of checklists or rating scales, but for this particular OSCE, checklists will be utilized. While initially, OSCEs were timed, this particular OSCE will not be performed under a time limit (Onwudiegwu, 2018). The POCUS for the detection of a pneumothorax OSCE will also only have one station. However, the three tasks required in the one station include navigating the machine correctly, demonstrating accurate scanning techniques to find landmarks and proper techniques in detecting a pneumothorax. SRNAs will have opportunities to watch a video and practice the OSCE to determine areas that need improvement before clinical rotations. Instructors will also be able to use the OSCE to evaluate student progression. Utilizing the OSCE approach enables the SRNA to practice communication skills, increase their understanding of anatomy, and improve the psychomotor skill of performing a POCUS to detect a pneumothorax (Onwudieguwu, 2018).

The theory that best fits with the OSCE framework is the Cognitive Learning Theory. According to Aliakbari et al. (2015), cognitive psychologists lean more toward the idea that learning is enhanced through understanding and doing rather than observing. Therefore, this theory best fits the OSCE framework because it holds the SRNA to the expectation of taking the motor skills they have been taught regarding proper POCUS machine usage and applying it to a critical patient situation. The hands-on aspect of the OSCE coincides with the Cognitive Learning Theory because the student is prompted to use necessary thinking skills rather than simply observing a skill (Aliakbari et al., 2015).

DNP Essentials

The Doctor of Nursing Practice (DNP) Essentials is necessary for the formation of a doctoral project. To ensure that this doctoral project was well-rounded, the authors sought to utilize each DNP essential. Table 1 shows the essentials that were used for this study.

Table 1

DNP Essentials

DNP Essentials	Clinical Implications
DNP Essential I: Scientific Underpinnings for Practice	This project examined research regarding evidence-based practice for detecting a pneumothorax with a point-of-care ultrasound to potentially improve patient outcomes.
DNP Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking	The goal of the project is to improve SRNAs critical thinking, use of POCUS, and use POCUS to detect a pneumothorax
DNP Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice	Synthesis and analysis of literature for pertinent data related to POCUS usage and the detection of pneumothorax with POCUS
DNP Essential IV: Information Systems/Technology and Patient Care Technology for the Improvement and Transformation of Health Care	This project aims to implement an OSCE to evaluate the SRNA's use of POCUS in the detection of pneumothorax. The authors developed this project from evidence obtained through research to improve patient care.
DNP Essential V: Healthcare Policy for Advocacy in Healthcare	A goal of this project was to develop an OSCE so that SRNAs could potentially improve both learning and clinical skills
DNP Essential VI: Interprofessional Collaboration for Improving Patient and Population Health Outcomes	The OSCE was both created and edited with the collaboration of SRNAs, Faculty Members, and CRNAs whose input was appreciated and implemented.

Table 1 (continued).

DNP Essential VII: Clinical Prevention and Population Health for Improving the Nation's Health	A goal of this OSCE is to increase SRNA confidence and reduce the stress of learning a new skill. Which, in turn, can potentially improve patient outcomes.
DNP Essential VIII: Advanced Nursing Practice	The SRNA will be responsible for accurately using a POCUS to detect the absence or presence of a pneumothorax.

Specific Aims

Understanding when the utilization of POCUS may be beneficial in detecting a pneumothorax can be challenging. Furthermore, proper technique and understanding when findings need further evaluation may also be a challenge to the SRNA. This OSCE assumes the SRNA has a basic understanding of the signs and symptoms of pneumothorax and the anatomy being examined with POCUS. Therefore, this OSCE aims to ensure the SRNA can use the POCUS correctly, use proper scanning techniques to identify proper landmarks, express an understanding of the ultrasound findings, and understand when a POCUS may be beneficial to detect whether or not a patient has developed a pneumothorax.

Additional goals of the doctoral project are to provide an OSCE module and video for SRNA education regarding POCUS use in diagnosing a pneumothorax. There is growing evidence showing that using POCUS and traditional exams to aid in early diagnoses can improve patient outcomes (Zieleskiewiez et al., 2021). Once the SRNA has watched the video and completed the OSCE, the SRNA will be more equipped to use a POCUS accurately, find landmarks efficiently, and have the skill set to use a POCUS to detect a potential pneumothorax. Instructors can also utilize the OSCE to determine

student preparedness before beginning their clinical rotation. Overall, if the goals of the OSCE are met, it will enable the SRNA to have a better educational experience, and patients will have improved outcomes.

Summary

The USM NAP does not have an OCSE for SRNAs to practice and evaluate their POCUS skills. The literature supporting the utilization of OSCEs to improve student performance is evident; therefore, the authors of this doctoral project created an OSCE for understanding the POCUS machine, the proper use of POCUS, and understand when POCUS can be used to diagnose a pneumothorax. For the SRNA to benefit from the OSCE, the SRNA must have a basic understanding of anatomy. Once the SRNA has a grasp on that knowledge, they can use the POCUS OSCE to gather confidence, improve motor skills, and use POCUS to detect pneumothorax. This OSCE will improve the SRNA's learning experience, provide hands-on practice, and ultimately improve patient outcomes in the clinical setting.

CHAPTER II - METHODOLOGY

At the University of Southern Mississippi's Nursing Anesthesia Program, no OSCE for the utilization of POCUS for detecting a pneumothorax exists. Without a POCUS OSCE, SRNAs do not have the opportunity to learn the correct usage of POCUS for detecting a pneumothorax before clinical rotations. Therefore, an OSCE was made so students can learn how to use POCUS and understand when it is appropriate to add POCUS into their physical examination to detect pneumothorax. This knowledge and skill set could improve both SRNA performance and patient outcomes.

The authors conducted a literature review to establish the proper technique of POCUS and how to utilize POCUS to determine whether a pneumothorax is present. The authors also deemed that the best way to teach SRNAs how to use POCUS would be through an OSCE format. As POCUS use in anesthesia is increasing, it is essential that SRNAs are educated on how to use the POCUS machine correctly and when POCUS usage is appropriate.

Context

An email was sent to SRNAs, NAP USM Faculty, and numerous anesthesia providers to request participation in this study. Each participant was asked to give consent before participating in this study. Participants were asked to review the OSCE template, and the best-practice guidelines, and complete a questionnaire. The participants were also asked to review the OSCE's evaluation tool that instructors can utilize to determine whether or not a student met the clinical objectives of the OSCE. This OSCE will be available in a print form that can be found in the simulation lab, the electronic

library for the NAP, and in the NAP Application for mobile devices. This OSCE could also be incorporated into the NAP curriculum.

Design

In determining how SRNAs can utilize POCUS technology in their clinical experience and the best ways to teach SRNAs how to use POCUS effectively, search engines such as Google Scholar, PubMed, EBSCO Host, and Cochrane Library were utilized. Keywords used for the search included Point of Care Ultrasound, POCUS and anesthesia, POCUS and regional anesthesia, POCUS and pneumothorax, Central Venous Catheter and pneumothorax, trauma, and pneumothorax, and POCUS and patient outcomes. All articles published before 2012 were excluded from the research.

The completion of this project began after approval from the Institutional Review Board (IRB) at The University of Southern Mississippi. The demonstrational video, OSCE, and questionnaire were sent to the targeted audience, and data was obtained from those who completed the questionnaire. Qualitative data, such as the comments surveyors made, and quantitative data, such as the number of responses received were all considered. Once the data was obtained and analyzed, it was noted that no changes needed to be made to the OSCE. The data was then presented to the USM DNP committee per IRB regulations for final approval.

Interventions, Measures, and Analysis

Intervention

The policy proposal for the author's POCUS OSCE began with IRB approval from USM. After receiving IRB protocol number 22-1323 (Appendix A), an OSCE on POCUS was prepared based on evidence-based and peer-reviewed literature. The authors

then presented the identified steps of using POCUS in a video presentation. A panel of experts that surrounded the education of POCUS was then selected. The OSCE was then submitted for approval from the DNP committee at USM. The authors then submitted the approved OSCE, video presentation, and report of findings with references to the panel of experts. The experts evaluated the OSCE and video presentation through an anonymous survey. All the responses were recorded, organized, and locked away. The authors analyzed feedback to determine whether any alterations needed to be made to the POCUS OSCE. If alterations were to be made, they would have reflected feedback if it was supported by evidence-based research. The OSCE was then submitted for approval by the DNP Project Chair Committee. Next, the OSCE and video presentation was presented to the NAP faculty to consider implementation into the current curriculum. Lastly, the authors disseminated OSCE at USM Scholarship Day on March 3, 2023.

The goal for the evaluation of this OSCE was to choose a panel of experts comprised of professionals from different specialties. For instance, CRNAs who also serve as clinical preceptors for SRNAs were great candidates to evaluate the OSCE due to their knowledge and skills in the clinical setting paired with student mentorship. In addition, the authors chose a faculty member from USM's School of Leadership and Advanced Nursing Practice to assess the structure of the OSCE due to their experience with OSCE evaluation. Furthermore, vital panel members were USM NAP faculty members as they have first-hand experience with SRNA education and success. Lastly, the committee chair was a vital stakeholder as they aided in developing this OSCE.

Measures

The POCUS for detecting a pneumothorax OSCE could potentially provide a way for the USM NAP to evaluate SRNA's preparedness for clinical practice related to POCUS use. However, for the student to feel confident in the necessary skills, there must be a way to measure the effectiveness of the OSCE. Therefore, after reviewing the OSCE template with reported findings and the video presentation, the panel of experts and the SRNAs were presented with a survey specific to the OSCE. The survey allowed the authors to gather feedback on the clarity, standardization, and effectiveness of the OSCE. The survey questions were as follows: (1) Were the provided materials (Template & Demonstration Video) adequate for completing the OSCE? (2) Were the setting and equipment provided conducive to learning? (3) Does this OSCE offer the potential to prepare the student for clinical practice and increase student confidence? (4) Does the OSCE presentation reflect doctoral-level work? (5) Based on the provided OSCE, what could be done or added to improve this OSCE?

Questions one and two were developed to evaluate the structure of the OSCE. Question one focused on the clarity of the information provided, while question two determined whether the setting and equipment allowed the application of the available knowledge. Question three examined the effect of the OSCE on the SRNA. Specifically, it focused on determining whether the OSCE provided adequate knowledge on preparing the student with ample POCUS skills as they enter clinical practice and increasing the student's confidence level. Question four aided in determining whether the density of the OSCE is equivalent to that of doctoral work. Question five allowed the participant to provide feedback to enhance the OSCE to better the learning experience for SRNAs.

Analysis

Analysis of this OSCE was carried out by an anonymous survey completed by SRNAs and anesthesia providers willing to participate in this study. The survey contained qualitative and quantitative analyses. Quantitative analysis was demonstrated by yes or no questions in questions 1-4. Subsequently, the yes or no questions were further indicated by percentages. Question five allowed the participants to answer open-ended questions; thus, it produced qualitative data. Qualitative data was necessary because it allowed the authors to identify common themes in the feedback. The data collected from the anonymous survey participants were organized into a table and is provided in the following chapter. The feedback from the participants, with help from the evaluation tool, was taken into consideration for possible revision of the OSCE.

Ethical Considerations

This POCUS for detecting a pneumothorax OSCE was developed to improve patient outcomes and student educational experience. The OSCE was introduced to the professors of the NAP for the consideration of allowing the POCUS OSCE integration into the NAP curriculum. Incorporating the OSCE would allow for consistent learning for the students. Thus, a potential ethical concern would arise if the OSCE was not equally presented to all students and staff. For example, the OSCE could be incorporated into one course's learning objectives but may be left out of another course's objectives. Subsequently, the unequal administration of the OSCE would lead to two different dimensions of learning for the students. Therefore, introducing the OSCE for implementation at a program level would allow one to eradicate potential negligence and

provide a standardized level of education. In short, there are no standing conflicts of interest as the IRB oversaw possible ethical considerations.

Summary

As previously stated, this project is intended to create a standardized evaluation method for the use of POCUS for detecting pneumothorax for SRNAs before they enter clinical practice. To adequately assess the effectiveness of the OSCE, a panel of experts evaluated the OSCE by filling out a voluntary, anonymous survey created by the authors. Subsequently, the authors evaluated the survey data and made the necessary modifications. Lastly, a Best Practice Guideline was submitted for the DNP committee review.

CHAPTER III – RESULTS

At The University of Southern Mississippi's Nurse Anesthesia Program, no objective structured clinical examination for Pneumothorax Detection with a POCUS exists. If an OSCE for pneumothorax detection with a POCUS existed, it would enhance SRNA clinical performance and improve the quality of patient care. Therefore, an OSCE on detecting Pneumothorax with a POCUS was created and presented to the USM NAP. This OSCE teaches students the process of selecting the correct ultrasound settings and transducer, proper usage of the ultrasound, determining the correct landmarks, and detecting whether or not a pneumothorax is present. The study of the effectiveness of this OSCE was determined through an anonymous online survey sent to each USM NAP Cohort, USM NAP faculty members, and both CRNAs and Anesthesiologists that work in clinical sites that USM students attend. The survey will gather both quantitative and qualitative data as it allows participants to contribute their opinions on the educational experience.

As previously discussed, an email containing informed consent, the OSCE template, the OSCE video presentation, and the survey link was sent to all participants. Participants were informed that all answers on the Qualtrics© survey would remain anonymous. Both qualitative and quantitative data were gathered from the Qualtrics survey and analyzed. Table 2 details the demographics of the willing participants

Table 2

Participant Demographics

Number	Answer	Percentage	Count
1	1st Year SRNA	13.33%	6
2	2nd Year SRNA	33.33%	15
3	3rd Year SRNA	24.44%	11
4	CRNA	26.67%	12
5	USM Faculty	2.22%	1
	Total	100%	45

In regard to the quantitative results detailed in Figure 1, 100% of the participants agreed to the online consent. One hundred percent of the participants agreed that the materials provided were adequate for completing the OSCE. One hundred percent of the participants agreed that the setting and equipment provided were conducive to learning. One hundred percent of the participants agreed that this OSCE could prepare students for clinical practice and increase student confidence. Lastly, 100% of the participants agreed that the presentation reflected doctoral-level work.

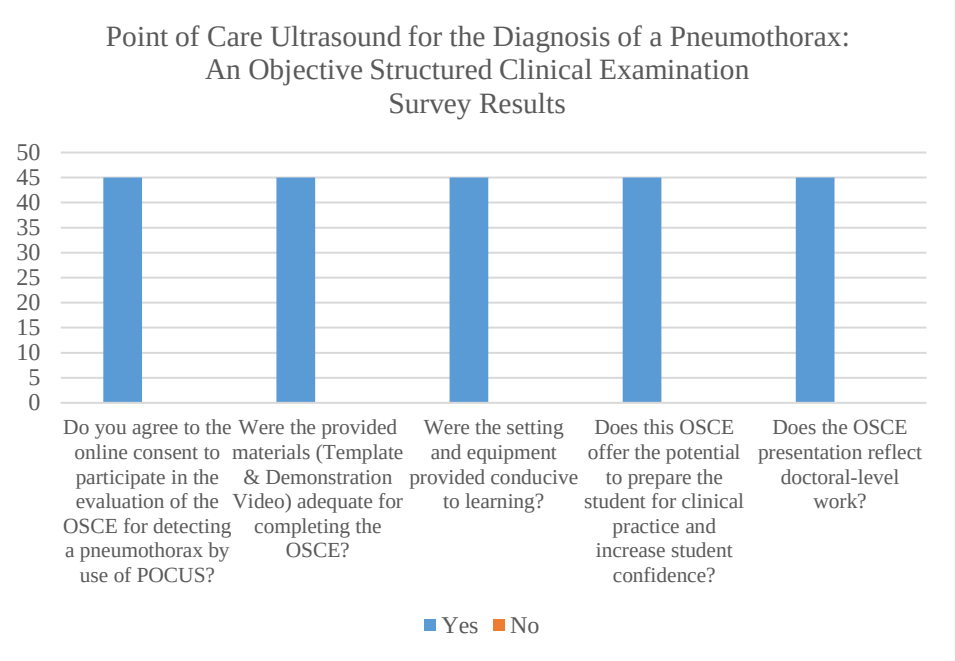

Figure 1. Quantitative Results

In regard to the qualitative results obtained from the anonymous survey, the feedback from the questions pertaining to anything that could be done to improve the OSCE consisted of "It was wonderful! Great job for students to use!", "Informative presentation," and "Everything looks great, very helpful!". An excerpt of constructive criticism was " the only thing that would be beneficial was that was not added would be a video showing the motion of the pneumothorax." Though a video was not used, the authors deemed Figure 2 to be sufficient due to the inability to find a non-copyrighted video.

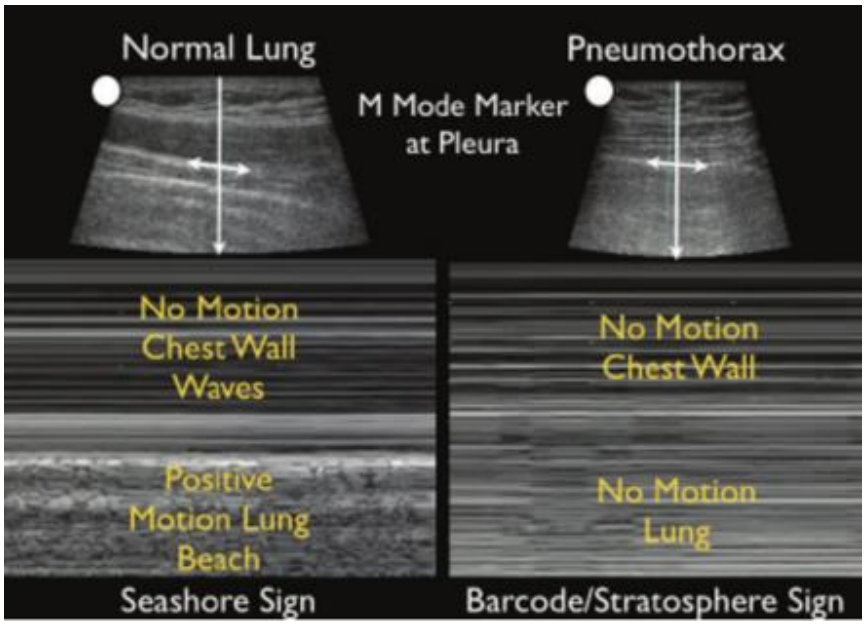

Figure 2. Pneumothorax Image

(Lewis, 2019)

Summary

In conclusion, the results gained from the survey pertaining to the OSCE for pneumothorax detection with a POCUS show that the implementation of such an OSCE can potentially benefit SRNAs' educational experience. This OSCE recognizes the growing presence of ultrasound usage in everyday anesthesia practice and provides a simulated experience for SRNAs to potentially gain confidence in using the ultrasound. This OSCE also recognizes that pneumothoraces can occur in many scenarios and settings involving anesthesia. Therefore, the implementation of this OSCE has the potential to enhance SRNAs' educational experience and clinical performance.

CHAPTER IV – DISCUSSION

Quantitative and qualitative analysis from the data collected from the participants was constructed in Table 2. When gathering the results from the participants, the measures and outcomes showed that 100% of participants thought the materials provided, such as the OSCE template and video, adequately addressed the previously mentioned gap of knowledge that currently exists at USM. The OSCE template provided a case scenario, equipment needed to perform a POCUS exam, steps to identify a pneumothorax using a POCUS, a debriefing form, and an assessment form. The data collected showed that the setting and equipment provided were conducive to learning. Based on the qualitative responses, the inclusion of a video, rather than a photo, of an abnormal lung in the OSCE video was a suggested criticism. However, the authors deemed Figure 1 acceptable due to the inability to find a non-copyrighted video. All other responses presented that no alterations were needed for the OSCE. Lastly, the results determined that the OSCE presentation demonstrated doctoral-level work and offered the potential to prepare students for clinical practice.

The panel of experts that participated and provided feedback in the evaluation of the OSCE presented an advantageous strength to the implementation of the OSCE. The wide range of participants allowed for unique perspectives. Specifically, the CRNA participants could provide feedback based on clinical experience and knowledge of evidence-based practice. The USM NAP faculty provided a unique perspective due to having vast knowledge of OSCE format and development and extensive knowledge of evidence-based practice as professors of nurse anesthesia. Lastly, SRNAs allowed for a view of learning the skill without any prior knowledge and being able to provide

feedback on whether the information provided was adequate. Thus, the comprehensive input from the participants offered essential vigor for developing and possibly incorporating the OSCE into the NAP at USM.

Interpretation

Intervention and Comparison of Outcomes

The results of the data collected propose that the OSCE for detecting a pneumothorax by using POCUS could be a practical intervention to manage the gap in standardized knowledge in pneumothorax detection and potentially improve student confidence along with patient outcomes by allowing for quick recognition and preparedness in detecting a pneumothorax in the clinical setting. The OSCE could offer a resource for current and future students, a standardized learning method with a clear expectation of grading required by the USM NAP faculty. Though the evaluation and outcomes of the OSCE produced positive results, more information is needed on this topic, making it challenging to compare the OSCE to similar projects. Based on evidence-based practice, there were no disparities in observed and predicted outcomes. The only recommended alteration was to provide a video of a lung with a pneumothorax rather than just a picture. The OSCE relates to the Cognitive Learning Theory as evidenced by the results from the participants, which suggest that the structure of the OSCE focuses on learning through understanding, thus potentially allowing for the SRNA to take the learned skills regarding proper POCUS machine usage and apply it to detect pneumothorax. As a result, the OSCE should permit positive results for the USM NAP, SRNAs, and patients.

Potential Impacts

The OSCE, the template, and the video demonstration could positively impact SRNAs that attend the USM NAP and patient outcomes by improving patient care. The OSCE could become a part of the USM NAP OSCE library, a database containing past OSCEs to help strengthen the curriculum. Subsequently, the OSCE could reduce the stress SRNAs feel as they enter the clinical setting by providing standardized knowledge on detecting a pneumothorax using POCUS. Though beneficial to the USM NAP, the OSCE has the potential to enter into other healthcare settings, such as emergency settings where there are high incidences of patients with pneumothoraces, continuing education modules, and orientation objectives for jobs that would require the ability to detect pneumothoraces.

The OSCE could allow for a consistent guide for procedure performance and expectations known by faculty and students, thus decreasing misinterpretation. The incorporation of the OSCE also provides a standardized grading system, potentially leading to decreased anxiety when being evaluated. The OSCE video can serve as another method of teaching by supporting the written materials, thus allowing students to learn through alternative teaching methods. The different aspects of the OSCE can allow students to learn independently and at their rate while developing a sound understanding of the competency before evaluation by an instructor.

Limitations

Potential limitations could manipulate the discernability of the OSCE. For instance, a possible limitation could be the small size of participants that evaluated the OSCE. However, to compensate for this potential limitation, the selected participants

were pursued due to their active involvement with clinical practice or the USM NAP in which this OSCE would be incorporated. In addition, the first-year SRNAs, though a part of the anesthesia program, may not have a history with OSCEs and are relatively new-found in learning anesthesia techniques; thus will be impartial and may have a novice understanding of how to diagnose a pneumothorax with POCUS.

Time constraints and lack of qualitative feedback proved another limitation for this OSCE. The addition of more qualitative questions within the survey could have provided additional valuable feedback; however, the participants who evaluated this OSCE are either practicing professionals or full-time students. Subsequently, the further qualitative questions would have increased the survey time and could have potentially eliminated the number of total responses due to the busy lives of the chosen participants. Therefore, concerning the participants' time, the survey was formed to contain the most significant objectives to acquire the best quality feedback with a nominal number of questions.

Best Practice Guideline

With the lack of a current objective structured clinical examination of Point of Care Ultrasound (POCUS) to diagnose a pneumothorax at USM, the authors developed a best practice guideline (Appendix C) using the research of current literature and evidence-based practice. With the use of supporting literature and evidence-based practice, a template and video was developed to show students the step-by-step process of detecting a pneumothorax by POCUS. The OSCE for detecting a pneumothorax with a POCUS can potentially improve patient safety, enhance the quality of care, improve student skill performance, and be used as a formative assessment for clinical readiness. Therefore, the authors recommend adopting the evidence-based OSCE into the nurse anesthesia curriculum.

Summary

In conclusion, this OSCE, the supporting documents, and the video presentation could serve as valuable tools for the SRNA and the USM NAP. If recognized by the NAP, the OSCE could be integrated into the USM NAP curriculum for clinical and didactic purposes and could be added to the OSCE library for student accessibility. As mentioned previously, the OSCE has the potential to be used as a continuing education module and could also be incorporated into other healthcare areas, such as emergency settings, and serve as an orientation objective into areas in which a pneumothorax may be encountered. Foremost, the OSCE could reduce stress on the SRNA as they move into clinical practice. In addition, the OSCE can offer a standardized evaluation of detecting a pneumothorax by POCUS, potentially leading to the practical teaching of skills essential for patient safety and student success.

APPENDIX A – 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:	22-1323
PROJECT TITLE:	Point of Care Ultrasound for the Diagnosis of a Pneumothorax: An Objective Structured Clinical Examination for Nurse Anesthesia
SCHOOL/PROGRAM	Leadership & Advanced Nursing
RESEARCHERS:	PI: Hannah Fortenberry Investigators: Fortenberry, Hannah~Parks, Stephanie~Dye, Shelby~Rayborn, Michong~
IRB COMMITTEE ACTION:	Approved
CATEGORY:	Expedited Category
PERIOD OF APPROVAL:	26-Oct-2022 to 25-Oct-2023

Donald Sacco Jr.

Donald Sacco, Ph.D.
Institutional Review Board Chairperson

APPENDIX B – Objective Structured Clinical Exam

Detection of a Pneumothorax with a Point of Care Ultrasound

LEARNER OUTCOMES:

The student will be able to:

1. Demonstrate knowledge of Point of Care Ultrasound (POCUS) usage and signs and symptoms of a pneumothorax.
2. Appropriately select the correct depth, gain, and ultrasound probe to detect a pneumothorax.
3. Identify the anatomical difference between a collapsed lung versus a normal lung

DOMAINS: Assessment, Didactic Knowledge, Clinical Skill

PURPOSE: Practice identifying the presence of pneumothorax with the correct usage of a POCUS.

LEARNER OBJECTIVES:

1. Demonstrate understanding of signs and symptoms of pneumothorax and correct technique of using a POCUS
2. Identify when POCUS can help identify a pneumothorax.
3. Demonstrate the ability to utilize the correct ultrasound settings to detect pneumothorax.
4. Demonstrate the identification of both a normal lung and a pneumothorax with the POCUS.
5. Analyze clinical skills and self-evaluate the technique.

INDIVIDUAL OR GROUP OSCE: Individual

REQUIRED READING and ASSOCIATED LECTURES:

1. Rayborn, M. (2022). *Lecture 1: Introduction to Ultrasound* [PowerPoint slides]. University of Southern Mississippi Basic Principles II Canvas: usm.instructure.com/course
2. Hines, R. L., & Marschall, K. E. (2022). *Stoelting's anesthesia and co-existing disease* (7th). Elsevier.
    1. Chapter 2 and Chapter 3
3. Nagelhout, J. J., & Elisha, S. (2018). *Nurse Anesthesia* (6th). Elsevier
    1. Chapter 29

REQUIRED VIDEOS: Detection of a Pneumothorax with a Point of Care Ultrasound Demonstration Video

REQUIRED PARTICIPANTS: Student Registered Nurse Anesthetists (SRNAs), Nurse Anesthesia Program (NAP) faculty examiner, clinical skills lab staff

VENUE: University of Southern Mississippi's School of Nursing Simulation Lab

STUDENT LEVEL OF OSCE: Semester 2-3 (prior to the start of clinical)

TIME ALLOTTED: 30 minutes

RECOMMENDED PRACTICE PRIOR TO EXAMINATION: Required readings X 2, required videos X 2, review of OSCE Scenario and expected performance, review of Detection of a Pneumothorax with a Point of Care Ultrasound steps X 2.

CONTENT OUTLINE

CONTEXT:

You are assigned to a 61-year-old male scheduled for an elective laparoscopic cholecystectomy with a past medical history of hypertension and COPD. The patient reports smoking a pack a day for the past 30 years. Airway assessment and labs are all

within normal limits. You have an unremarkable induction and place an endotracheal tube to prepare for the laparoscopic procedure. After incision and insufflation of the abdomen, you notice increased peak inspiratory pressures, decreased tidal volumes, hypotension, and a decrease in oxygen saturation. You decide to listen to the patient and notice decreased breath sounds on the left side and immediately suspect a pneumothorax. You notify the surgeon who aborts the procedure, and confirmation is needed.

Pneumothorax Detection with a Point of Care Ultrasound EQUIPMENT & SUPPLIES:

Monitors:

- EKG
- SpO2
- BP

Point of Care Ultrasound Machine

Linear Transducer

Ultrasound gel

SITE SELECTION: The anesthesia provider must be able to identify the structures on the anterior chest. The area in which air is most likely to collect is located at the midclavicular line in the 2nd or 3rd intercostal space on the most anterior portion of the patient's chest. Once obtaining an image with the probe, the anesthesia provider must locate two ribs to identify the pleural line.

TASK STATEMENT: The task is to demonstrate an understanding of diagnosing a pneumothorax by ultrasound by gathering the appropriate equipment, appropriately identifying the anterior chest anatomy, and understanding the process of determining whether a pneumothorax is present.

Pneumothorax Detection PROCESS:

1. Identify situations where the skill must be executed.
2. Prepare the appropriate equipment (see equipment/supplies listed above).
3. Identify the midclavicular line in the 2nd or 3rd intercostal space on the most anterior portion of the patient's chest.
4. Choose the high-frequency linear probe attached to the ultrasound.
5. Apply ultrasound gel to the linear probe.
6. Place the probe in sagittal orientation on the chest wall at the appropriate landmark (see above).
7. Identify the landmarks of two ribs and identify the pleural line that should be visualized between them.
8. If you are unable to find the two ribs, move the probe caudally until two ribs are visualized.
9. Once locating the intercostal space, scan medially and laterally to evaluate for lung sliding.
10. Hit M-mode on the ultrasound.
11. Using the probe, place the M-mode line in the center of the pleural line.
12. Hit M-mode on the ultrasound again.
13. Determine the presence of a seashore sign.
14. If the presence of pneumothorax exists, notify the appropriate staff and obtain the appropriate supplies to perform a needle decompression or chest tube.

DEBRIEFING FORM:

1. Were you able to demonstrate the objectives correctly?
2. Did you identify areas that needed clarification or remediation?
3. Were you satisfied with your ability to work through the simulation?
4. Has this OSCE better prepared you for clinical practice?

ASSESSMENT

Rubric for Detection of a Pneumothorax with a Point of Care Ultrasound

TASKS	PASS	FAIL	COMMENTS
1. Identify situations where the skill must be executed.			
2. Prepare the appropriate equipment (see equipment/supplies listed above).			
3. Identify the midclavicular line in the 2nd or 3rd intercostal space on the most anterior portion of the patient's chest.			
4. Choose the high-frequency linear probe attached to the ultrasound.			
5. Apply ultrasound gel to the linear probe.			
6. Place the probe in sagittal orientation on the chest wall at the appropriate landmark (see above).			
7. Identify the landmarks of two ribs and identify the pleural line that should be visualized between them			
8. If you are unable to find the two ribs, move the probe caudally until two ribs are visualized			

9. Once locating the intercostal space, scan medially and laterally to evaluate for lung sliding			
10. Hit M-mode on the ultrasound.			
11. Using the probe, place the M-mode line in the center of the pleural line.			
12. Hit M-mode on the ultrasound again.			
13. Determine the presence of a seashore sign			
14. If the presence of pneumothorax exists, notify the appropriate staff and obtain the appropriate supplied to perform a needle decompression or chest tube.			

The OSCE performed by the student demonstrates foundational knowledge and skill in Detecting a Pneumothorax with a Point of Care Ultrasound: (Circle one)

PASS FAIL

Does the student need to repeat this OSCE to satisfy learning requirements? (Circle one)

NO YES DATE TO RETURN FOR EVALUATION:

_____

EXAMINER: _____ DATE:

_____

APPENDIX C – Best Practice Guideline

Introduction

At The University of Southern Mississippi's Nurse Anesthesia Program, no current objective structured clinical examination of Point of Care Ultrasound (POCUS) to diagnose a pneumothorax exists. SRNAs should be confident in using POCUS due to the various procedures performed that can lead to the development of a pneumothorax. With POCUS use on the rise and required at many facilities, anesthesia providers need to be proficient.

Supporting Literature

Brumfield, N. (2021). *Effectiveness of Point-of-Care Ultrasound Education for Advanced Practice Providers* [Doctor of Nursing Practice project, The University of Kentucky]. DNP Projects. 364. https://uknowledge.uky.edu/dnp_etds/364

Kline, J. P. (2021). *Peripheral nerve blocks and ultrasound guidance: For anesthesia providers*. Twin Oaks Anesthesia.

Lewis, D. (2019). *PoCUS - Pneumothorax*. Department of Emergency Medicine | Saint John. https://sjrhem.ca/pocus-pneumothorax/

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Study

The OSCE was developed through the research of current literature and evidence-based practice. With the use of supporting literature and evidence-based practice, a template and video was developed to show students the step-by-step process of detecting

a pneumothorax by POCUS. It is recommended that students read the required text, watch the required video, and review the OSCE template twice or until the student feels confident. Once the student feels they have a grasp on the knowledge, they are encouraged to perform the OSCE with a peer. Once they have tested their knowledge with a peer, they are recommended to perform the skill with an instructor.

Outcomes

After reading the template and watching the required video, survey results showed that 100% of the participants agreed that the material provided was adequate for completing the OSCE, and 100% of the participants felt that the OSCE would prepare students for clinical practice and increase student confidence. Qualitative feedback consisted of the following:

· "It was wonderful! Great job for students to use!"

· "Informative Presentation."

· "Everything looks great. Very helpful!"

Recommendation

The OSCE for detecting a pneumothorax with a POCUS can potentially improve patient safety, enhance the quality of care, improve student skill performance, and be used as a formative assessment for clinical readiness. Therefore, the authors recommend adopting the evidence-based OSCE into the nurse anesthesia curriculum.

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