Development of Neuraxial Anesthesia Educational Videos for Nurse Anesthesia Students

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Literature Review

Introduction

Performance and evaluation of anesthetic procedures, specifically those pertaining to neuraxial anesthesia, are a core component of nurse anesthesia curriculums. These skills, including spinal and epidural placement, are a significant aspect of anesthesia practice. Teaching methods must provide nurse anesthesia students with the proper tools and knowledge to perform skills confidently and proficiently. Traditional teaching methods have fallen short of providing the necessary instruction for optimal student success (Coyne et al., 2018).

As technology continues to evolve in the educational setting, online media resources, such as instructional procedural videos, have become common. While students possess a variety of different learning styles, video resources have been shown to be extremely valuable in learning hands-on skills (Coyne et al., 2018). A 2011 study found that "the use of YouTube videos increased student engagement, critical awareness, and facilitated deep learning" (Clifton & Mann, 2011, p. 311). Additionally, student physical examination performance is enhanced by having access to procedural videos compared to more traditional methods of content delivery (Zhang & Chawla, 2012). Video learning is a tool that can be accessed at the student's convenience and replayed if desired; recorded media is not confined to a specific time and place like traditional lectures. However, with the unregulated content available across many online sources, students may encounter inaccurate, misleading, or biased information (Clifton & Mann, 2011).

Brame (2016) found that effective implementation of video as an educational tool was enhanced when educators considered how to manage the cognitive load of the video, how to maximize student engagement with the video, and how to promote active learning from the video. When following evidence-based strategies for video production, supplemental educational tools can enhance student learning of clinical skills in the didactic setting.

Aim Statement

This project aims to provide high-quality video-learning resources for spinal and epidural anesthesia for nurse anesthesia students enrolled in an introductory course at a university in the Midwestern United States. These video-learning resources intend to enhance student learning and improve student skill performance in the clinical setting. Prior to implementation, students' baseline understanding of neuraxial anesthesia will be assessed by a knowledge-based pre-test. After implementation, students will demonstrate a greater understanding of neuraxial anesthesia through improved scores on an identical post-test. An increase in knowledge and high satisfaction would suggest the successful execution of the project. This project's initial implementation will occur in the spring 2023 semester. Evaluation of the project will determine improvements needed for continued implementation in subsequent semesters.

Aim of the Literature Review

This literature review aimed to identify current evidence-based recommendations for spinal and epidural anesthesia and gain a better understanding of the benefits and limitations of video learning in nurse anesthesia education. Questions that guided this literature review include:

1. What is the best evidence surrounding procedural steps for neuraxial technique?
2. How effective are instructional videos compared to other learning strategies?
3. What effect do structured rubrics and protocols have on learning clinical skills?

Search Strategy

The current literature was reviewed using scholarly databases, including the Cochrane Database of Systematic Reviews, PubMed, and the Cumulative Index of Nursing and Allied Health Literature (CINAHL). The following search terms were used: neuraxial anesthesia OR spinal anesthesia OR epidural anesthesia AND best practice OR guidelines OR recommendations OR evidence-based practice. Inclusion criteria were applied to this search to contain only peer-reviewed articles published from 2011-2022 written in English. This search yielded 205 articles. Abstracts were reviewed, and upon determination of relevance, 22 articles were included in this literature review.

A separate search was conducted using the previously mentioned databases with the following search terms: video learning OR multimodal learning AND nursing students OR graduate students AND clinical skills OR clinical competence OR clinical knowledge. Results were filtered only to include those published between 2011-2022 in English and peer-reviewed. This search yielded 29 articles, 12 of which were determined to be most relevant and were included in this review.

A third search was conducted through the same databases and inclusion criteria to determine the effects of structured rubrics and practice protocols on learning. The following search terms were used: rubrics OR practice protocols AND development OR creation AND nursing OR anesthesia. This search yielded 114 articles. Following the removal of duplicates and abstract review, eight of these articles were included in this review.

To further analyze the findings of this literature review, articles were divided into categories based on their focus. All included studies focused on video learning and its place in educational settings, whether alone or in a multimodal approach. Seven studies were specific to health-related fields; five concentrated on using video learning in clinical skills. The latter was most valuable to the review, as those studies were more related to the project topic. There were no articles found that were specific to nurse anesthesia practice.

Although outside the exclusion criteria of being published in the past ten years, a study conducted by Kelly et al. (2009) was examined due to its specific focus on clinical skills in nursing education. In this study, over half of the participants expressed that the most advantageous part of video learning was the ability to watch the videos repetitively to augment their understanding (Kelly et al., 2009). Additional resources from major anesthesia organizations, including the American Association of Nurse Anesthesiology [AANA] and the New York School of Regional Anesthesia [NYSORA], were used.

Results

Learning Methods

First developed in 1987 and recognized in literature in 1992, VARK is a learning style theory that suggests there are four different types of learners (Fleming & Mills, 1992). The name itself is an acronym for the different learning styles. These include visual, aural (or auditory), read/write, and kinesthetic. The VARK Questionnaire uses a brief survey to determine an individual's preferred learning style(s). While the term' learning style' can be much more complex, the VARK Questionnaire focuses on determining how people like information to come to them and the way(s) in which they prefer to deliver their comprehension of what they have learned (Fleming & Mills, 1992). VARK suggests that all learners fall into one or more categories; individuals can be unimodal, bi-modal, tri-modal, or multimodal learners (Fleming & Mills, 1992). Data from a 140-person cross-sectional exploratory survey showed that the majority of students (63.5%) had a bimodal way of studying (J.P. & Ranadev, 2018). The important takeaway from understanding students' learning styles is that learning is not a 'one-size-fits-all' approach. While common themes exist, everyone has preferences that help them learn best. Through their research, J.P. & Ranadev (2018) urge faculty to determine the learning preferences of their pupils and incorporate those styles into their teaching to make the learning process more effective.

Multimodal or Blended Learning

Advances in technology have revolutionized how students learn. While preferred learning methods may vary from student to student, the introduction of multimodal learning has opened new educational avenues. Forbes et al. (2016) sparked debate about the lack of effectiveness of traditional teaching methods, which gave rise to the idea of multimodal or blended learning. In education, the term "multimodal" can be described as the utilization of multiple modes to deliver teaching and learning materials (Bloomfield et al., 2011). A blended approach to delivering learning materials provides a more comprehensive opportunity for knowledge gain and understanding than a singular delivery form (Forbes et al., 2016). Effective clinical skills education that is flexible and accommodates different learning needs is crucial to student success in the clinical setting, where expectations are high (Higgins et al., 2019).

Video Learning

Video learning for clinical skills is an excellent adjunct to traditional teaching methods. In the healthcare setting, implementing educational videos significantly improves adherence to protocol during a complex medical procedure (Kandler et al., 2016). Providing video learning material in the asynchronous format allows students to re-access content at any time, rather than receiving information once during a classroom lecture. Videos are valued by students and have been shown to be equal to, or superior to, more traditional teaching methods, such as in-class lectures (Fong et al., 2019). Skills videos enable students to become more competent as future providers (Kelly et al., 2009). Demonstration of clinical skills via video has been shown to improve healthcare professionals' relative level of competence when learning and performing that skill (Higgins et al., 2019).

To optimize the effectiveness of video learning, careful consideration of three elements should be included for video design and implementation: cognitive load, student engagement, and active learning (Brame, 2016). Cognitive load must be managed so that important information will be retained, as the working memory has a limited capacity. Cognitive load can be minimized using techniques such as signaling to highlight important information, segmenting to chunk information, weeding to remove extraneous information, and using audio and visual cues to convey complementary information (Brame, 2016). Student engagement will be enhanced by using conversational language and speaking quickly with enthusiasm. Keeping the video brief will decrease mind wandering and increase the likelihood of the student watching the video (Brame, 2016). Also, using the video as part of a more extensive assignment will increase student motivation to watch the video and learn (Brame, 2016).

Practice Protocols

Practice protocols aim to teach, provide direction and guidance, standardize procedures, increase consistency and efficiency, and avoid conflict or misunderstanding (MacLachlan et al., 2012). Protocols should be evidence-based and guided by national professional organization recommendations. The most up-to-date information (preferably from the last two years) should be included in the protocol. In addition, protocols should be reviewed periodically to assess the need for updates (MacLachlan et al., 2012).

According to Ahmed et al. (2017), implementing procedural protocols can enhance care provision by providing clear guidance based on the current best evidence related to the specific procedure. Practice protocols provide a standard of care and are fundamental in nursing and all other healthcare settings.

Grading Rubrics

Rubrics are tools used for grading student work. In nurse anesthesia programs and other health-related fields, rubrics are often used to rate students' performance of clinical skills. Rubrics communicate expectations and make grading more consistent and objective (Massachusetts General Hospital Institute of Health Professions [MGHIHP], 2021). Components of a rubric might include the assignment description or task, criteria, levels, and detailed standards for performance (MGHIHP, 2021). Rubrics allow students to understand an instructor's expectations on an assignment and how it aligns with the course objectives, improve their performance by integrating instructor feedback, and evaluate their work (Chaaban, 2019). In order to measure the thoroughness of performance, rubrics should be easy to follow, and expectations should be clear (Chuan et al., 2015). Standards for performance are often split into separate steps or tasks, allowing for the measurement of targeted and detailed parts of the procedure (Chuan et al., 2015). Rubrics should align with the practice protocols and be based on current evidence-based practices.

Neuraxial Anesthesia

Neuraxial anesthesia has been a mainstay of anesthesia practice since the turn of the 20th century (New York School of Regional Anesthesia [NYSORA], 2018). Neuraxial anesthesia includes spinal (intrathecal), epidural, combined spinal-epidural, or dural puncture epidural techniques (Pellegrini, 2017). Neuraxial anesthesia involves the administration of medications into various layers of the spinal canal to produce anesthesia or analgesia by blocking the transmission of nerve impulses directly at the spinal nerve roots (NYSORA, 2018). The use of neuraxial anesthesia, rather than general anesthesia, is associated with a reduction in risk for a range of adverse perioperative outcomes (Weinstein et al., 2018). Because of this, neuraxial anesthesia is implemented as the primary anesthetic technique in many types of surgical procedures, including orthopedic, obstetric/gynecologic, cardiothoracic, vascular, urologic, and colorectal procedures, among others.

Risks. Common risks associated with neuraxial anesthesia include hypotension, which can be offset with fluid administration or the administration of an alpha-1 agonist such as phenylephrine (NYSORA, 2018). Rare complications, including injury to the spinal cord or nerve roots, infection resulting in abscess, and hematoma, may also occur (Pellegrini, 2017). A risk specific to epidural anesthesia is an inadvertent dural puncture, which can result in headache and backache (Pellegrini, 2017). Rare and potentially more serious epidural risks include inadvertent administration of an epidural dose of local anesthetic into the subarachnoid space leading to a high spinal with the potential to cause cardiovascular or respiratory compromise, and unintended vascular administration of medication leading to a condition known as local anesthetic systemic toxicity (LAST), which can lead to cardiovascular collapse if not recognized and treated rapidly (NYSORA, 2018).

Contraindications. While the indications for neuraxial anesthesia are ever-growing, several contraindications do exist. These contraindications remain controversial and can vary by provider and facility. Absolute contraindications are patient refusal, sepsis, and infection at the intended site of injection (Pellegrini, 2017). Coagulopathies, pre-existing central nervous system disorders, back injury, spinal abnormalities, aortic stenosis, and elevated intracranial pressure are relative contraindications to neuraxial anesthesia (NYSORA, 2018). Patient selection is critical and should be driven by a careful history and physical examination.

Sterile Technique. Before performing neuraxial anesthesia, the provider must perform proper hand hygiene to prevent contamination. The use of alcohol-containing solutions or alcohol alone (e.g., isopropyl alcohol) results in improved disinfection compared to handwashing with plain antiseptic solutions such as povidone-iodine or 4% chlorhexidine (Siddiqui et at., 2017). Therefore, it is recommended that anesthesia providers perform hand hygiene with an alcohol-based antiseptic solution for maximal bactericidal effect prior to placement of neuraxial anesthesia (Siddiqui et at., 2017). Current recommendations support the use of a mask, head covering, sterile gloves, and sterile draping when performing any regional anesthetic technique (Chin & Van Zundert, 2018). Due to the lack of current research, the use of sterile gowns while administering neuraxial anesthesia remains controversial in the United States (Aleman-Ortega et al., 2017). Chlorhexidine 0.5% in alcohol should be chosen for skin antisepsis before performing neuraxial anesthesia over a 2% Chlorhexidine solution due to its neurotoxic effects and no evidence suggesting a higher chlorhexidine concentration has a superior effect (Campbell et al., 2014). Because of its neurotoxic properties, chlorhexidine must completely dry before skin palpation or puncture (Campbell et al., 2014). If gloves show evidence of chlorhexidine contamination, they should be changed before moving forward (Campbell et al., 2014). No evidence-based guideline exists outlining chlorhexidine dry time, but studies suggest it may take up to 195 seconds (Gunka et al., 2019).

Monitoring. Anesthesia providers should ensure proper monitoring and resuscitative medications are available before beginning the spinal anesthetic. Monitors, including continuous pulse oximetry, continuous ECG, and non-invasive blood pressure monitoring, are required before, during, and after the placement of a neuraxial anesthetic to quickly identify and treat possible complications (NYSORA, 2018). Blood pressure readings should be set to take on one-minute intervals as hypotension is likely. To reduce the risk of neuraxial-induced hypotension, a higher dose of local anesthetic with a prophylactic phenylephrine infusion may be a superior strategy to simply using a lower dose of local anesthetic (Xiao et al., 2018). If the patient is pregnant, fetal monitoring should also be utilized (Chin & Van Zundert, 2018).

Spinal Anesthesia

Spinal Technique. Lumbar puncture technique begins with adequate patient positioning. The sitting position is most common as it allows for symmetrical visualization of the spinal anatomy, but the lateral decubitus position may also be used. With the patient positioned in the sitting position and legs hanging from the side of the bed, they should be encouraged to maintain a flexed spine position to help open the interspace (Olawin, 2021). Ensuring a comfortable environment for the patient and provider independently increases the likelihood of first-attempt success (NYSORA, 2018). Successful identification of lumbar interspaces is done by palpating the iliac crests and following that plane to locate the L4 vertebrae. The desired interspace can be found by counting up or down from this location. Neuraxial ultrasonography has become increasingly popular for neuraxial space identification when landmarks are not visible. Ultrasound imaging could reduce the risk of failed or traumatic lumbar punctures and epidural catheterization, as well as the number of insertion attempts, and is recommended for best clinical practice (In Chan et al., 2021).

The skin should be prepped with chlorhexidine 0.5% in alcohol solution and draped in a sterile fashion exposing the chosen spinal interspace (Campbell et al., 2014). After waiting at least two minutes for proper drying, use 1% lidocaine and a small gauge needle to make a skin wheel to numb the desired path (Gunka et al., 2019). Using the midline approach, an introducer needle is placed into the skin at the midline with a slight cephalad angle at the desired interspace (NYSORA, 2018). The paramedian approach can be used where the introducer needle is placed about 2 cm from the midline and then advances at an angle toward the midline (NYSORA, 2018). In this approach, the supraspinous and interspinous ligaments are usually not encountered (Olawin, 2021). A spinal needle is then advanced through the introducer needle, passing through subcutaneous tissue, supraspinous ligament, interspinous ligament, ligamentum flavum, epidural space, dura mater, and subarachnoid mater to reach the subarachnoid space. The stylet is then removed from the needle to assess for free flow of cerebral spinal fluid (CSF). After free flow of CSF is established, aspiration on the syringe is done to visualize CSF swirling in the syringe then injection of the local anesthetic slowly at a speed of less than 0.5 mL/second is completed (NYSORA, 2018). Additional aspiration of CSF at the midpoint and end of injection can be attempted to confirm continued subarachnoid administration but may not always be possible when small needles are used (NYSORA, 2018). The introducer and spinal needle are then removed together as a unit, and the patient is quickly assisted to the desired position based on desired block location and baricity of the local anesthetic injected. Close monitoring of vital signs and block height is imperative, with quick intervention if indicated (NYSORA, 2018).

Spinal Needles. Lumbar puncture had historically been performed with a sharp cutting point (Quincke) needle, but noncutting needles with a rounded pencil-point tip (Whitacre and Sprotte) were developed in the 1980s in order to limit dura mater fiber lesions and leakage of cerebrospinal fluid, minimizing the risk of post-dural puncture headache (Cognat et al., 2021). Cutting point needles result in a five-fold increase of cerebral fluid leakage compared to noncutting needles of the same gauge and thus should be chosen as the primary needle for a spinal anesthetic (Cognat et al., 2021). Needle diameter or gauge commonly ranges from 27 gauge to 19 gauge for dural puncture. There is a significant increase in the risk of post-lumbar puncture headache when using a larger gauge needle, and thus, a small gauge needle should be the first choice for spinal anesthesia (Cognat et al., 2021). A larger gauge needle may be needed depending on the technique and patient anatomy.

Spinal Dosing. Local anesthetic choice, dosage, and adjuvant agent addition must be determined based on patient history, desired block height, surgical position, drug baricity, and desired recovery time. For outpatient spinal anesthetic cases, the primary considerations are rapid onset of adequate surgical anesthesia, rapid recovery of motor function, proprioception, and ability to void, as well as minimizing adverse effects (Eng et al., 2014). Bupivacaine is the most commonly used local anesthetic for spinal anesthesia because of its predictable sensory blockade, fast onset, and decreased risk of conversion to general anesthesia (Tubog et al., 2018). The calculated minimum effective dose (ED50) of intrathecal bupivacaine 0.75% is between 4.7 mg and 9.8 mg (Tubog et al., 2018). 2-Chloroprocaine offers remarkably rapid recovery, but vigilance for adverse effects is advised (Eng et al., 2014). Intrathecal lidocaine carries a significant risk of transient neurologic symptoms (TNS) and should be avoided (Eng et al., 2014).

Local anesthetic baricity is a factor that must be considered when choosing the appropriate drug for each spinal anesthetic. When comparing hyperbaric bupivacaine and isobaric bupivacaine, both provided adequate anesthesia with no difference in the failure rate (Uppal et al., 2017). The hyperbaric formulation allows for a rapid motor block onset with a shorter motor and sensory block duration. The isobaric formulation has a slower onset and provides a longer duration of both sensory and motor block (Uppal et al., 2017). Hemodynamic fluctuations and a decline in blood pressure and heart rate were more pronounced in individuals who received hyperbaric compared to isobaric anesthesia. Hence, an isobaric spinal is beneficial when physiological stability needs to be optimized (Watters, 2012).

Spinal Adjuvants. Adjuvant medications may be added to the local anesthetic to produce alterations in the spinal anesthesia effect. Vasoconstrictors such as epinephrine and phenylephrine may be added to prolong the duration of action by limiting the systemic reabsorption of the local anesthetic (NYSORA, 2018). Opioid agonists are commonly used to reduce the dose of intrathecal local anesthetics and improve the block quality; however, they are often accompanied by undesirable adverse effects such as urinary retention, pruritis, nausea and vomiting, and respiratory depression (Sun et al., 2017). Evidence supports the use of lower doses of intrathecal opioids, specifically 0.1 morphine, to achieve optimal analgesia with minimal adverse effects (Gomez et al., 2020). Compared to fentanyl, dexmedetomidine, an alpha-2 agonist, as local anesthetics adjuvant in spinal anesthesia prolonged the duration of spinal anesthesia, improved postoperative analgesia, reduced the incidence of pruritus, and did not increase the incidence of hypotension and bradycardia (Sun et al., 2017).

Epidural Anesthesia

While there are a growing number of uses for epidural analgesia and anesthesia, epidurals are used most often for analgesia in a laboring parturient. Epidural catheters allow for intermittent and continuous infusions of medications to decrease pain (AANA, 2017).

Epidural Technique. Patient positioning is a crucial aspect of epidural administration essential to successful placement. Most commonly, patients are positioned in a sitting position, but there may be circumstances where this position is not feasible. In these situations, patients can be placed in a lateral decubitus (side-lying) position. Prone or jackknife positioning may also be used (NYSORA, 2018). The sitting position is the most optimal position for access to the epidural space (NYSORA, 2018). In this position, the patient should be instructed to assume a hunched or “mad cat” position, relaxing the shoulders, tucking the chin to the chest, and pushing the associated portion of the back (most commonly lumbar or lower back) out toward the anesthetist. This position aids in opening the vertebral spaces (NYSORA, 2018).

There are three techniques that can be used to identify the epidural space: loss of resistance technique, hanging-drop technique, and ultrasound-guided technique. Among these, the loss of resistance technique remains the most common (NYSORA, 2018). The loss of resistance technique can be used with air or saline; however, more complications are associated with the use of air; therefore, saline is recommended (NYSORA, 2018; AANA, 2017).

It is common practice to locate the appropriate interspace prior to donning sterile gloves. By palpating the posterior superior iliac spine, the provider can locate the level of L4. This landmark is known as Tuffier’s line (Holladay & Sage, 2021). After opening the epidural kit and donning sterile gloves, the provider will cleanse the area with an appropriate cleaning solution, such as povidone-iodine or 0.5%-2% Chlorhexidine gluconate. Povidone-iodine works by drying the skin (Holladay & Sage, 2021). Evidence suggests that chlorhexidine is more effective as an antiseptic agent than povidone-iodine, though if the patient has an allergy to chlorhexidine gluconate, povidone-iodine should be used (Campbell et al., 2014). Krobbuaban et al. (2011) found that epidural catheters inserted after chlorhexidine gluconate prep were six times less likely to become colonized with bacteria when compared to those inserted after povidone-iodine prep. Practitioners should be aware of the risks and benefits of all antiseptic skin preparations (including the various concentrations available). Chlorhexidine gluconate is a known neurotoxic agent; therefore, extreme caution should be taken when using this solution (Campbell et al., 2014). Recommended safety measures with the use of chlorhexidine gluconate include: keeping the solution away from other supplies in the kit, allowing the solution to dry completely before the neuraxial block attempt, and changing gloves if there is suspicion of contamination with the solution. Despite the possibility of neurotoxicity, literature has shown that the benefit of superior prevention of site infection outweighs this risk (Checketts, 2012).

A sterile drape will then be placed on the patient's back, exposing the prepped area. Approximately 3 milliliters of 1% lidocaine are used to localize the skin prior to insertion of the epidural needle. The provider will then insert the epidural needle, most commonly a 9-centimeter Tuohy needle approximately 2 centimeters, traversing the skin, subcutaneous tissue, and supraspinous ligament, and eventually seating the needle in the interspinous ligament. The anesthetist will connect the loss of resistance syringe. Using continuous or intermittent pressure on the syringe, the needle should be very slowly advanced, only about 0.25 centimeters (about 0.1 in) at a time, until a noticeable give ensues (Antibas et al., 2014). This "give" is described by Antibas et al. (2014) as a sudden loss of pressure on the plunger of the syringe, making the plunger slide smoothly. Administration of 2–3 milliliters of saline into the epidural space is theorized to open the space to allow for easier threading of the catheter (Antibas et al., 2014). The literature does not strongly suggest a significant difference in the efficacy or safety between air and saline for the loss of resistance; however, air administration into the epidural space can cause a patchy block or, more seriously, pneumocephalus (Antibas et al., 2014). Once loss of resistance is achieved, the needle should be immobilized. A small catheter is then threaded through the needle into the epidural space. The visible markings on the epidural needle should be examined to determine the depth to the epidural space. The needle is then carefully removed with the catheter still in place. The catheter may then be pulled back to the appropriate centimeter marking at the skin. The optimal distance the catheter should be left in the epidural space is 4–6 centimeters to minimize complications and maximize analgesia (Belin et al., 1995).

Epidural Test Dose. Before administering any medication through the epidural catheter, the provider should aspirate with a syringe to ensure no return of blood or cerebrospinal fluid, both of which would signify misplacement of the catheter in the intravascular or intrathecal spaces, respectively (NYSORA, 2018). The initial dose of medication administered through the epidural catheter is known as the test dose. The purpose of the test dose is to rule out the displacement of the epidural catheter into an unintended space. The test dose most commonly consists of 3 mL of 1.5% lidocaine (45 mg) with 1:200,000 (15 mcg) epinephrine. If the catheter is in the intrathecal space, the patient will experience a fast and profound motor blockade (NYSORA, 2018). If the catheter is placed intravascularly, the patient will experience a 20 percent or more increase in heart rate within one minute of injection (NYSORA, 2018). Either of these responses constitutes a positive test dose. In the event of this, additional doses of medication should not be administered, and associated symptoms should be treated promptly. If none of these symptoms occur within 5 minutes, the test dose is considered negative, and the anesthetist may proceed with the dosing of medication through the epidural catheter (NYSORA, 2018). In the obstetric population, there have been instances where maternal and fetal complications have occurred secondary to an epidural test dose (Massoth & Wenk, 2019).

Furthermore, Massoth and Wenk (2019) state that some providers believe the routine administration of lidocaine and epinephrine for an epidural test dose is outdated and should be reconsidered. According to Massoth and Wenk (2019), some providers feel that a fraction of the epidural bolus dose with low-concentration local anesthetic can be used as the test dose. The incidence of intravascular insertion of the epidural catheter will likely present itself as a failed block quickly, allowing for time to replace the catheter prior to concern for symptoms of systemic toxicity (Massoth & Wenk, 2019). While there are no current recommendations from the American Society of Anesthesiologists (ASA) or the American Association of Nurse Anesthesiology (AANA) regarding the discontinuation of the standard test dose, expert associations in Germany state that if the initial dose of local anesthetic does not exceed that of the typical test dose (3 ml), then that bolus may be used as the test dose and a traditional dose is not required (Massoth & Wenk, 2019). This may be grounds for changes to practice standards in the future; however, it is never recommended to deviate from current practice standards, which in the United States, include the use of a standard test dose.

Epidural Dosing. Dosing of the epidural depends on numerous factors, notably patient height, and can be done via intermittent bolus administration, continuous infusion, patient-controlled bolus administration, or a combination of these (NYSORA, 2018). The spread of local anesthetic in the epidural space directly correlates with the volume administered. Dilute concentrations of ropivacaine and bupivacaine are the most used local anesthetics for epidural administration. Low concentrations (0.1-0.25%) of local anesthetics have been shown to be superior to higher concentrations in providing analgesia (Silva & Halpern, 2018). In addition, compared with higher concentrations, lower concentrations of local anesthetics led to higher patient satisfaction (Silva & Halpern, 2010). Continuous epidural analgesia through an epidural catheter has become increasingly popular and allows for pain management over a prolonged period. In the event of breakthrough pain, a clinician can give the patient a bolus of medication through the catheter. Patient-controlled analgesia allows the patient to self-administer boluses through the pump at time intervals determined by the provider. The bolus dose can vary and is also set by the provider. Most commonly, bolus doses for breakthrough pain range from 4 to 12 milliliters. Continuous infusion doses at a rate of 5–12 milliliters per hour are generally acceptable (Silva & Halpern, 2010). The height of the patient should be taken into consideration when dosing epidurals, and the dose should be adjusted accordingly for people of very short and tall stature (Silva & Halpern, 2010). A widely accepted guide for dosing epidurals is 1–2 milliliters per segment to be blocked; for example, if a lumbar epidural is placed at the L3-L4 interspace and a T10 level block is necessary for labor analgesia, the proper bolus dose would range from 6-12 milliliters (NYSORA, 2018).

Epidural Adjuvants. Similar to spinal anesthesia, certain medications can be administered via epidural catheters to produce analgesia alone or in combination with local anesthetics to improve the quality of the block. The most common epidural adjuvants include opioid agonists and alpha-2 agonists. Many other medications, such as cholinesterase inhibitors, ketamine, and midazolam, have also been studied, with varying results (NYSORA, 2018). While the mechanism of action is not fully understood, alpha-2 agonists, such as dexmedetomidine and clonidine, have been shown to prolong the duration of neuraxial blockade when combined with local anesthetics (NYSORA, 2018). Additionally, alpha-2 agonists can reduce local anesthetic requirements in labor epidural analgesia, provide adequate analgesia without motor blockade, and modulate surgical stress response, among other benefits (NYSORA, 2018). Another major benefit of epidural administration of alpha-2 agonists versus opioid agonists is the lack of respiratory depression and nausea and vomiting, which are the principal side effects of neuraxial opioid administration (NYSORA, 2018). When dexmedetomidine and clonidine are compared to one another, they produce very comparable benefits and side effect profiles (Soni, 2016). Side effects of alpha-2 agonists include dose-dependent hypotension, bradycardia, and sedation (NYSORA, 2018).

Discussion

The role of the Certified Registered Nurse Anesthetists (CRNA) requires them to be adequately educated and trained in their skills prior to entering the clinical setting. Along with a vast clinical knowledge base, clinical skills form the foundation of CRNA practice, and clinical skill education represents a vital component of the nurse anesthesia education curriculum. There are a variety of ways in which students learn; therefore, educators must understand the different learning styles of nurse anesthesia students and incorporate each style into the curriculum to allow for a more comprehensive education and clinical preparedness (J.P. & Ranadev, 2018; VARK, 2022).

Although qualitative data suggests that video learning is effective in increasing students' understanding of skills, it may not be as effective in increasing test scores (Fong et al., 2019). While video learning resources are useful in helping students learn, there is not enough data to support the replacement of traditional teaching methods. Because of this, implementing a video learning component should act as a supplemental tool and not replace any current learning techniques. Literature has shown that the utilization of additional methods, such as videos and simulations, has proven to be more effective in teaching students clinical skills (Clifton & Mann, 2011; Coyne et al., 2018; Higgins et al., 2019; Kelly et al., 2009; Zhang & Chawla, 2012). By creating new avenues for students to learn, we broaden the educational experience. Creating high-quality videos to teach nurse anesthesia students clinical skills allows us to reach more learners effectively. The implementation of video learning in the nurse anesthesia curriculum will complement traditional methods and engage students at a higher level (Bloomfield et al., 2011; Forbes et al., 2016; Higgins et al., 2019)

This project will reduce the need to search online video platforms (i.e., YouTube) to find supplementary resources to aid students' learning. As these types of platforms are openly accessible to both content creators and consumers, the quality of the materials can sometimes be questionable (Fong et al., 2019). A thorough review of the literature on neuraxial anesthesia helps ensure that the information in the videos is consistent with the most current evidence. In addition, this evidence-based information will be incorporated into the rubrics and curriculum for neuraxial anesthesia at this university. In addition, these asynchronous video resources will give students the ability to refer to them at any time and frequency, allowing them to improve their skills and gain a better understanding of the topics discussed (Kandler et al., 2016; Fong et al., 2019; Kelly et al., 2009).

While procedural videos have been effectively used in the training programs of other healthcare disciplines, there needs to be more exploration into the use of video as a learning aid in anesthesia education (Fong et al., 2019). There are some issues with comparing the results from those studies with this literature review, specifically the significant differences in the nature of anesthesia procedures versus those taught in other healthcare fields. Another issue comparing studies from other healthcare disciplines is the variance of implementation methodologies. Additional research should be conducted to better understand the use of video learning among nurse anesthesia professionals, specifically.

Conclusion

The literature strongly suggests that video learning as a component of multimodal learning is beneficial in a variety of educational settings. More specifically, it effectively teaches students clinical skills in various health-related fields. Neuraxial anesthesia is a major skill set that the anesthesia provider must master. Additionally, using clear rubrics will help guide students through the process and help them understand exactly what is expected of them. This systematic approach to completing neuraxial anesthesia skills will better prepare students for the clinical setting and their future careers. The information in this literature review will be used to create skills videos and updated rubrics to be added to the current curriculum to facilitate a multimodal learning approach to neuraxial anesthesia. Through this quality improvement project, we aim to improve SRNA knowledge and skills surrounding spinal and epidural anesthesia.

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