

DNP Scholarly Project Paper:

Clinical Techniques of Regional Anesthesia

Spinal and Epidural

Fourth Edition

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### Abstract

This paper explores the DNP scholarly project of rewriting the fourth edition of *Clinical Techniques of Regional Anesthesia – Spinal and Epidural Blocks*. The project involved editing and updating the text to include the most recent evidence-based practice recommendations from the literature and professional guidelines to provide practicing anesthesia providers and students with an up-to-date clinical resource. The photographs, drawings, and tables were updated to reflect contemporary practice. The work will be published by the American Association of Nurse Anesthetist.

*Keywords:* spinal, epidural, guidelines, best practice

## **Introduction and Problem Statement**

Parturients who request or require obstetric anesthesia services represent a unique challenge to anesthesia providers. Techniques for providing pain relief during labor and delivery are continuously being refined to provide the best care possible. A thorough understanding of the anatomic and physiologic changes that occur during pregnancy and the anesthetic considerations associated with such changes are necessary for a safe and effective anesthetic course. Clinicians who care for women in the perinatal period face the important task of remaining current in the best evidence-based practice. An up-to-date clinical manual can provide teachers and learners a capsule of essential technical concepts described in a narrative that leads to improved success and safety with neuraxial techniques. Obstetrical anesthesia providers care for a vulnerable population and require specific educational material and “Clinical Techniques of Regional Anesthesia” (2019) is specifically designed to meet that need.

## **Background and Significance**

Obstetric anesthesia has changed dramatically over the last 30 years. The use of general anesthesia for cesarean sections has decreased and the use of regional neuraxial anesthesia for cesarean section and labor analgesia has experienced a corresponding increase. In the U.S. it is now estimated that 66% or 2.7 million women annually receive neuraxial anesthesia in labor and delivery (Osterman, 2015). Determinations regarding the overall quality of obstetrical anesthesia in the United States are often guided by closed insurance claims analysis performed by content experts with the guidance of professional associations. These projects carefully examine settled malpractice claims to establish trends in complications and causation (Davies, 2010) which are utilized to improve practice patterns. The total number of obstetric anesthesia claims from 1980 to 2003 relative to peri-operative occurrences has remained stable at 12-13% (Leighton, 2009).

The character of the claims has changed in that maternal and newborn death and brain damage is significantly lower while maternal nerve injury, back pain, and headache have increased likely reflecting the increased use of regional anesthesia. High spinal related respiratory impairment and inadequate equipment preparation are now the leading causes of maternal mortality and are largely preventable when anesthesia providers follow basic guidelines (Mhyre, 2013).

### **Purpose**

It is the responsibility of certified registered nurse anesthetists to provide compassionate and competent care in an expedited manner that takes into consideration the needs and requests of the parturient. After a patient requests epidural analgesia, it is the role of the anesthesia provider to select an anesthetic modality based on the patient's condition, their own skill level and experience. Neuraxial techniques for labor analgesia represent the most effective method for relieving the pain of childbirth and are continuously being refined to provide the best care possible to this vulnerable patient population.

There is a need for updated resources and educational material to address what is, essentially, a preventable and inexcusable trend in complications. Resources available to practitioners should include the latest evidence-based practice guidelines and recommendations and, as a result, medical textbooks and manuals undergo regular updates. This DNP project is designed to address this deficiency by contributing to the updated fourth edition of *Clinical Techniques of Regional Anesthesia: Spinal and Epidural Blocks* (Reese, in press).

The goal of this project is to create a resource to meet the needs of the practicing obstetrical anesthesia provider. Those who provide anesthesia services are thoroughly trained and certified however, the functional application of neuraxial anesthesia represents a level of

practice above the mastery of mechanical dexterity or the memorization of steps. The aim of the project is to present material in a way that concentrates not only on the principles but the subtleties of technique and best-practice.

### **Synthesis**

Certified registered nurse anesthetists (CRNAs) who provide obstetrical anesthesia services encounter a great diversity of diseases, drugs, and procedures in their practices and many require unique approaches for best-practice management. Contemporary anesthesia care is broad and complex as knowledge has advanced consistently over time. Clinicians require sources of information beyond simple professional experience or education that may have been completed years ago. Approximately 600 articles were reviewed that pertained to neuraxial anesthesia in obstetrical practice which yielded over 300 articles for use in updating the material. The literature review focused on evidence that would have a significant impact on everyday practice.

The combined spinal epidural technique (CSE) was studied by Booth (2016) utilizing a single-center retrospective cohort survival analysis to determine that CSE techniques do not delay recognition of epidural catheter failure (Level III A). Multiple retrospective trials have indicated that catheters placed as part of a traditional epidural technique fail at a higher rate than catheters placed as part of a CSE technique (Pan, 2004) (Level II A). The use of programmed intermittent epidural boluses (PIEB) with patient controlled epidural analgesia (PCEA) was reviewed and found to confer no additional risk relative to continuous epidural infusion (CEI) with PCEA (Carvalho, 2016) (Level I A). Potential advantages included more uniform spread of local anesthetic (LA), LA sparing effect, and improvement in maternal satisfaction.

A systematic review and meta-analysis of the effects of CSE versus epidural analgesia on nonreassuring fetal heart rate (FHR) tracing revealed that CSE is associated with a higher risk of nonreassuring FHT. It was unclear if the FHR changes led to an increase risk of cesarean delivery (Hattler, 2016) (Level II B). A total of 17 randomized controlled trials were included in the quantitative synthesis (3947 parturients). A focused review was published regarding the failure to extend epidural labor analgesia for cesarean delivery (Mankowitz, 2016). Predictive factors were the need to treat breakthrough pain with additional boluses, use of an epidural technique compared to a CSE, inexperienced providers, and the urgency of the cesarean delivery. Importantly, techniques to manage the failed epidural were reviewed that included the safe use of reduced spinal doses as part of a repeat CSE and continuous spinal anesthesia utilizing epidural equipment (Level II B). An excellent article that highlights the importance of multidisciplinary simulation drills and effective communication strategies to manage obstetrical emergencies provided a template for adapting drills to individual department needs (Austin, 2016) (Level III B).

A study was designed to establish the optimal time interval between PIEB of 10 mL volume to produce effective analgesia in 90% of women in first stage labor without breakthrough pain (Epstein-Kanczuk, 2017). After testing 40 women at 30, 40, 60, and 90 min intervals it was determined that the estimated effective interval 90% was 42.6 minutes (95% confidence interval). This study reflected analgesia during first stage labor only and further studies are warranted to determine effectiveness throughout labor (Level I A). The dural puncture epidural technique is a modification of the CSE technique, where a dural perforation is created with a spinal needle but intrathecal medication is withheld. This technique improves caudal spread of analgesia compared with EPI without the side effects. Chau (2017) hypothesized that the onset

of labor analgesia would follow the order: CSE > DPE > EPI. In a RCT of 120 patients, it was found that analgesia onset was most rapid with CSE with no difference between EPI and DPE (Level I B).

Recent work has continued to focus on the integration of lumbar ultrasound assistance in neuraxial anesthesia. In parturients undergoing elective cesarean delivery who had impalpable lumbar spinous processes, ultrasound guidance reduced the number of needle passes required to successfully complete the procedure (Creaney, 2017) (Level I B). In a random controlled trial where women were assigned to either conventional palpation or ultrasound assistance, Ekinci (2017) found that successful subarachnoid puncture on the first attempt was significantly higher in the ultrasound group (Level I A). Lastly, a wonderful study compared five techniques for pre-procedure hand washing and determined that the use of alcohol gel alone, without drying, clearly performed better than all other methods in reducing bacterial growth from practitioner's forearms (Siddiqui, 2017). This work represents an excellent opportunity to expand a reader's evidence-based knowledge to enhance patient safety.

In summary, multiple high-quality studies have addressed technique, dosing, block extension, the use of ultrasound, and infectious complications. These studies adequately reflect on and add to the information required to safely and effectively provide obstetrical anesthesia and analgesia and provide a basis for practice recommendations. A review of the evidence regarding a subject as broad as neuraxial anesthesia will never be inclusive of every study and article which is a weakness. The sections assigned were topic specific limiting the integration of all available evidence.

## **Concepts and Theoretical Framework**

The reciprocal interaction world view describes the relationship between this project and practice (Fawcett, 1993). Essentially, this view reflects a pragmatic approach that considers responses to external forces and inputs. For example, to effectively evaluate a component problem, such as a knowledge deficit, in a large and complex system, the entire being and organization must be considered in context with the component. The foundation of simultaneity describes humans as active beings that exhibit reciprocal interaction with the environment that is often critical to understanding the causes of disturbance.

The evolution of evidence-based practice traces the process of informed clinical decision making from the use of single studies to the newer approach that emphasizes the appraisal of all relevant studies and their application to a particular patient, setting, and situation (Melnik & Fineout-Overholt, 2004). A practitioner may reference a single study or clinical experience as proof that a therapy is an appropriate part of everyday practice whereas scholarship involves the connection and application of isolated facts synthesized from multiple sources. In this manner, this project has taken research, translated it into “practice-ready” information, and disseminated it to practitioners. The intent of the project as it relates to the objectives is to leverage this concept in a way that will have the greatest impact on nurse anesthesia practice by integrating high quality evidence into a widely-used book. The goal is to move contemporary APRNs from clinical decisions and interventions based on on-the-job experience to research based evidence.

## **Project Design**

Charles Reese, CRNA, PhD is the primary shareholder, author and my practice mentor for the purpose of this project. He has authored all previous editions of Clinical Techniques of

Regional Anesthesia utilizing various contributing authors and is ultimately responsible for section assignments, content, schedule, and costs. Dr. Reese is the primary contact and resource for matters pertaining to content and makes decisions regarding assignment of sections to other contributing authors. The authors group meets in person three times a year in conjunction with the American Association of Nurse Anesthetists (AANA) National Meeting and the regularly scheduled AANA Spinal and Epidural Workshops. The publishing branch of the AANA is the publisher and is led by Bruce Shoneboom, PhD, CRNA, FAAN, Chief Learning Officer. The chief learning officer established and manages the budget for illustrations and permission to reprint. Ewa Greiner and Cristina Graham are, respectively, director of professional development and director of professional practice at the AANA.

The project is a part of a larger group effort and interprofessional communication has been integral to functioning effectively. Editorial meetings that include the writing team as well as the non-professional AANA staff occur every three to four months. In these meetings decisions are made regarding content, focus, illustrations, and diagrams. Writers share ideas for improvement with the publisher's staff and collaborative decisions are made. Although obstetrical applications represent most neuraxial anesthesia use, this edition includes material for applications outside obstetrics such as pediatrics and general surgery. Content experts in those areas have provided technical support in the form of consultation and review as needed.

Manuscripts are written in a standard word processing program and exchanged via email attachments. Manuscript modifications, additions, and deletions are made to the root document using a tracking mode. The primary author requested that modified documents be exchanged incrementally.

The first step in the successful completion of this project involved an intense review of the literature, the assessment of applicable articles for quality, and their physical collection and organization for future reference. A project of this scope requires a high level of organization and ease of access for resources. Key words were searched using primarily PubMed, MEDLINE, and Medical Subject Headings (MeSH). A single spreadsheet subdivided into 13 individual sheets/categories was used to hold all articles. Each reference is listed by date, author (last name, first initial), AMA format citation, keywords. The spreadsheet can then be searched using any of the reference descriptors. There is a single separate file that contains the articles in PDF form identified by AMA citation which contained 373 articles. The spreadsheet and reference file was created specifically for this project and frequently updated. Reference acquisition was accomplished via Loansome Doc.

A medical illustrationist was contacted and estimates were obtained for updated drawings. The primary author and editors ultimately declined the opportunity to replace diagrams due to cost constraints making the determination that the overall quality of the final product would not be materially affected. However, multiple photographs of neuraxial block placement procedures were replaced to reflect changes in practice guidelines. For example, the recently published Practice Advisory for the Prevention, Diagnosis, and Management of Infectious Complications Associated with Neuraxial Techniques (ASA, 2017) recommends that watches be removed during the placement of neuraxial anesthetics. Several photographs depicting insertion techniques included the wearing of a watch and were replaced. New photographs were obtained by a professional photographer utilizing volunteer models in a simulated anesthetic administration. Photographs for inclusion in the final product were selected by the primary author and editorial staff.

### **Data Analysis and Results**

The editor requested the book be easy to read and widely encompass the elements of anatomy, physiology, and technique designed for the practicing clinician as well as the novice student. It is published in English only therefore the target audience is English speaking obstetrical anesthesia providers. The initial assignment involved rewriting the chapter titled “Epidural Anesthesia”. Sections involving pediatric spinal and epidural, sterile technique, and anticoagulation were subsequently added to the assignment. The anticoagulation section was fortuitous as the American Society of Regional Anesthesia and Pain Medicine recently published the fourth edition of the evidence-based guidelines for regional anesthesia in the patient receiving antithrombotic therapy (Horlocker, 2018). This section was an excellent opportunity to further disseminate critically important guidelines that all practitioners must integrate into practice.

### **Relationship of the Results to the Aims and Objectives**

The fourth edition of Clinical Techniques of Regional Anesthesia is in the final production stage and is scheduled to be released January of 2019. The fourth edition now contains updated sections on preoperative assessment and patient preparation, techniques and positioning, equipment and pharmacology. Relative and absolute contraindications were revised to include recently published recommendations for patients receiving anticoagulant therapy. The section on pharmacology of epidural and spinal anesthesia was enhanced to include practice information regarding the obstetrical use of different preparations of local anesthetics. Drug shortages have become common and include local anesthetics used in obstetrical practice. The commonly used hyperbaric form of bupivacaine is in short supply in many areas necessitating

the use of the isobaric form. This isobaric form is not commonly used in the U.S. and resulted in a unique opportunity to address several of the practice issues involved its use (Kasson, 2018).

The objective of this project was to provide an up-to-date resource to be used by obstetrical anesthesia providers that reflects the most current information available. Both students and practicing providers will gain knowledge and practice skills based on current evidence. This was accomplished by utilizing an extensive literature review, updated tables, figures and photographs.

### **Strengths and Limitations of the Project**

A major limitation of a project of this type is the inability to quantify quality of the book itself and overall practice improvement. The project's use of quantitative data in the context of establishing quality improvement is limited. Qualitative data in the form of review and input by faculty and students could be used to provide guidance for modifications in future editions. Obtaining multiple reviews from as many sources as possible will enhance interrater reliability. Measuring internal consistency can be accomplished with the use of a survey tool specifically designed to solicit a reader's impression of the quality of the book. Success of the project will ultimately be determined by number of units sold and if it is adopted as required reading in anesthesia programs. Trend improvement in obstetric anesthesia closed claims as a result of this book is subject to an enormous number of confounding variables and lacks any appreciable amount of specificity. The extended cycle between measurement periods will also result in a negligible ability to assign causation meaning that this measurement lacks validity. Overall units sold lacks a great amount of face validity insofar as it may be a requirement of a course to purchase the book and, therefore, it is not related to quality. The most valid measurement of quality of the project and one that is in the category of content validity is the number of

anesthesia training programs that require the book. This qualitative determination of quality reflects the impressions of those responsible for academic preparation of students who are close to content experts.

The national benchmark for quality in publishing anesthesia related texts and manuals could be considered the acceptance of the work as required reading for teaching institutions. In that case, this project is of high quality if it is required reading. The timeline for acceptance should be one year from the date of publication.

In summary, the project's success in meeting the objectives involves two layers. The first is the quality of the book itself and, secondarily, its effect on the quality of care delivered. Neither are easily subject to quantitative measurements but the former can be assessed using qualitative measures.

### **Recommendations and Implications for Future Practice**

There is an ongoing need for updated anesthesia practice resources. Contributing to the need is consolidation in anesthesia practices that has resulted in significant shifts in the way providers deliver care. CRNAs are increasingly being asked by new group owners and hospital employers to expand coverage across a spectrum of services that may include obstetrical anesthesia. These providers will then require a reliable source of information pertaining to anatomy, physiology, pharmacology, and complications associated with neuraxial techniques.

New information is continuously being developed and there is an ongoing need to collect, synthesize, and condense that information into a source that is available and readable to obstetrical anesthesia providers. The Council on the Certification and Recertification of Nurse Anesthetists has recently updated the requirements for continued licensure to include re-boarding

through a written examination. Updated editions of this book will fulfill an important role in preparation for that examination.

### **Dissemination Plan**

This project has been accepted for publication and is in production at this time. It is scheduled for general release in January 2019. It will be available online via the AANA bookstore and online retailers. The AANA publishing group will display the book at all AANA sponsored meetings including the Assembly of School Faculty, the National Congress, and the Leadership Academy starting in February 2019. The Assembly of School Faculty is the annual national meeting for CRNA program faculty and is attended by faculty from all 121 programs.

A public presentation of the project takes place at Northern Kentucky University in November 2018. The presentations are attended by faculty, advisors, and family. The book is also distributed to every attendee of the AANA Spinal and Epidural Workshops that are held three times a year and attended by approximately 120 CRNAs annually. Much of the material, research, and articles is integrated into presentations scheduled for 2019. At this time, I am scheduled to present lectures containing this project's material at the AANA Spinal Epidural Workshop in October 2018, May 2019, and August 2019 in Chicago. Lectures are also scheduled for Wisconsin March 2019 and Idaho May 2019.

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