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Epidural analgesia Effect in Labor and Delivery

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To my mother: Thank you for making it possible for me to pursue my dreams. Thank you for taking care of me, for worrying when I was worried, for feeding me, and for taking care of my kids and household. Thank you for giving me strength and the inspiration to keep going when the going got tough. You have sacrificed so much so I can achieve in life. You put your life on hold so I could finish school. Words are not enough to describe my gratitude and love for you. You taught me to help people from an early age, especially those less fortunate than me. Midwifery will allow me to help women in bigger and better ways than nursing did. Mom, you have helped me and many others, and I will continue your legacy by helping women in whatever way I can.

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Abstract

Background/Purpose:

The purpose of this paper is to critically review the current research on the effects of labor epidural analgesia on laboring progress, mode of delivery and neonatal outcomes in international communities.

Theoretical Framework:

Mercer's middle range theory of Maternal Role Attainment was used as the theoretical framework for this review. This theory pertains to the woman's psychosocial preparation and adaption to motherhood. The perception of the birth experience can alter or enhance the motherhood adaptation process. Nurse-Midwives use this theory as a guiding principle to help women achieve a successful transition to motherhood by reducing adverse environmental factors and promoting self-efficacy.

Methods:

Twenty scholarly research articles were appraised and reviewed to determine the impact of epidural anesthesia on labor progress, mode of delivery and neonatal outcomes.

Results/Findings:

When low concentration epidural analgesia is used, there was no significant difference in the duration of first of labor. Study results were inconclusive in the effect of epidural analgesia on second of labor. Most of the studies found an increased risk for instrumental delivery and no increase in risk of cesarean delivery when epidural analgesia was used. There was no effect on the neonate's Apgar score, but delayed initiating of breastfeeding and reduced duration was observed when epidural anesthesia was used for labor analgesia

Implications for Research and Practice:

Nurse-Midwives incorporate scientific evidence into clinical practice. Understanding the risks and benefits associated with epidural analgesia enables the nurse-midwife to counsel women and their families so that they are able to make informed consent and shared decision-making.

Keywords:

Keywords used for the research of this article include: epidural effects on labor progress, epidural analgesia labor outcome, labor epidural and cervical dilation, intrapartum epidural analgesia, epidural versus non-epidural or no analgesia in labor, and epidural effect on neonatal outcomes.

Table of Contents

Chapter One: Introduction

For most women, the process of childbirth is painful. Childbirth labor pain ranks high in severity when compared to other types of pain (American College of Obstetricians and Gynecologists [ACOG], 2017). Women's responses to labor pain are influenced by many factors: the type of labor (spontaneous or induction), the birthing environment, the birthing mother's cultural background, her preparation for labor, and the support persons (Sanders & Lamb, 2014). Therefore, each woman's response to labor pain is different. Some women are able to cope with labor pains without any external support, and others ask for pain relief assistance.

Labor epidural analgesia is widely used around the world especially in countries where modern medicine is available such as United States, Europe, China, Japan, Turkey, Iran, Israel, and Nigeria (Sng et al., 2014; Anim-Somuah, Smyth, Cyna, & Cuthbert, 2018; Rukewe, Adebayo, & Fatiregun, 2015). The techniques and concentration used may be different in each country and therefore, the effects of the epidural analgesia could be different making comparison of research outcomes difficult. Globalization of knowledge and information brings opportunities and challenges to the obstetric provider. Patients are getting information from the internet, family, and friends (Sutton & Carvalho, 2017). Additionally, many U.S. based nurse-midwives care for patients who have immigrated from countries with different health care systems and have knowledge or make assumptions about U.S. healthcare based on their country of origin. Therefore, it is important for the nurse-midwife to have an understanding of healthcare in other countries in order to give accurate information and counseling.

Nurse-midwives are primary care providers to laboring women; they are knowledgeable about giving comfort to laboring women. In addition to providing non-pharmacological pain relief options, they also provide information and guidance regarding pharmacological pain relief

options. Pharmacological methods such as parenteral opioids or regional anesthesia in the form of epidural (most common) and combined-spinal epidural are the options offered to women who are laboring in hospitals (ACOG, 2017).

Statement of Purpose

The purpose of this paper is to critically review the current research on the effects of labor epidural analgesia on laboring progress, mode of delivery and neonatal outcomes in international communities. The international review is chosen for this appraisal as the international community is doing the most current research on epidural analgesia and its effect on labor. Furthermore, nurse-midwives may care for patients or encounter providers or research from other countries and therefore, it is important to be up to date with current research.

Epidural anesthesia has the potential to alter labor progress, mode of delivery and neonatal outcomes. The current research on the effects of epidural anesthesia is contradicting on certain effects of epidural analgesia and labor. For example, some studies show that epidural analgesia prolongs the second stage of labor (Shmueli et al., 2018; Genc et al., 2015) while other studies show epidural has no effect on the duration of second stage (Shen et al., 2017; Singh, Yahya, Misiran, Masdar, Nor, & Yee 2016). Epidural analgesia is an intervention that may lead to a cascade of interventions that lead to less than desirable outcome (Sanders & Lamb, 2014). These may include prolonged or stalled labor, operative delivery, neonate that does not transition well to extrauterine life, and/or affected breastfeeding initiation and duration (Anim-Somuah, Smyth, Cyna, & Cuthbert, 2018).

Evidence Demonstrating Need

It is important for nurse-midwives to practice evidence-based care and be knowledgeable on the most up-to-date labor pain treatment methods. Ninety-four percent of nurse-midwives in

the United States practice in hospitals where epidurals are accessible (American College of Nurse-Midwives [ACNM], 2016). Labor epidural anesthesia was first introduced in the early 1900's. Since that time, the techniques and drugs used has significantly improved (Halpern & Silva 2010). Developed nations, such as United States and Canada, have almost perfected the science of epidural analgesia. The systematic reviews show the impact of anesthesia on labor outcomes such as prolonged second stage and instrumental deliveries are rarely seen with low dose, low concentration labor epidurals since the late 2000s (Anim-Somuah, Smyth, Cyna, & Cuthbert, 2018; Wang, Sun, & Huang, 2017; Wong 2017; Halpern & Silva 2010).

Epidural usage rates differ greatly across countries. In U.K, it is about 20% (Anim-Somuah, Smyth, Cyna, & Cuthbert, 2018), 50% in China (Hu, Flood, Li, Tao, Zhao, Xia, Wong, 2016) and upwards of 60% of laboring women request an epidural at some point during labor in the United States (Gibson, 2014). Labor epidural analgesia, while popular and effective in pain labor management, is not without risk. Risks include prolonged second stage, instrumental delivery, maternal hypotension and fever (Grant, 2018; Sng et al., 2014).

The main professional organizations in the United states that represent maternity care providers in hospitals are ACOG and ACNM. In other countries, they have similar organizations such as the Royal College of Obstetricians and Gynecologists, the Royal College of Midwives in U.K or the Australian College of Midwives. There is a distinction between the obstetrician-gynecologists organization where birth is medicalized and midwifery organization that promote birth as a normal process (Garcia-Lausin, Perez-Botella, Duran, Rodríguez-Pradera, Gutierrez-Martí, & Escuriet, 2019). Nurse-midwives provide holistic care with minimal technological interventions (Newnham, McKellar, & Pincombe, 2016). Nurse-midwives believe in *physiologic birth*. A physiologic birth is a birth powered by the innate abilities of the woman and fetus.

Obstetric interventions, such as medications and/or surgery, may disturb the normal physiologic birth process (Royal College of Midwives, 2019; ACNM, 2013; Newnham, McKellar, & Pincombe, 2016). ACNM does not have an explicit position statement for or against epidural analgesia. Nevertheless, it does list epidural anesthesia as disruptive to the physiologic birth (ACNM, 2013). Furthermore, one of the core principles in midwifery is shared decision making between the birthing woman and her provider. The woman is given evidence-based information and ample time to decide what is right for her. Therefore, each woman's birth preferences are respected and supported if and when she chooses interventions such as epidural analgesia.

World Health Organization [WHO] (2018) and ACOG (2017) state labor pain management is essential in obstetric care and women who request an epidural should be given one in the absence of contraindications. Furthermore, ACOG (2017) describes regional techniques, such as epidural and spinal, provide pain relief during labor with minimal adverse maternal and neonatal effects. The ACOG (2017) practice advisory statement indicated multiple times that labor analgesia, whether epidural or other methods, does not appear to increase the risk for cesarean section delivery and therefore should not be withheld.

In comparing the two professional organizations, ACNM and ACOG, it becomes evident that there are two different philosophical understanding of what labor pain is and how it should be treated. ACNM sees labor pain as part of a normal process of birthing, a process best left undisrupted (Gibson, 2014). ACOG sees pain as a condition that should be treated with whatever methods and options are available.

The International Confederation of Midwives [ICM] (2017) representing midwives in over 113 countries also has a position statement regarding labor interventions. On an international scale, midwives acknowledge that every intervention potentiates the possibility of

adverse effects and thus ICM encourages respect and support for the normal birth process and judicial use of interventions such as epidural analgesia with informed consent. In Britain, the Royal College of Midwives (2019) has active initiatives promoting intervention free births such as epidural analgesia and promoting the normal physiologic birth. In countries where midwives have more prominent presence and independent practice like United Kingdom, epidural analgesia use rates are low in the 20% compare to places like the United States where epidural use in much higher, >60% (Newnham, McKellar, & Pincombe, 2016; Anim-Somuah, Smyth, Cyna, & Cuthbert, 2018).

The most current systematic reviews on the effect of epidural analgesia on labor progress, delivery type, and neonatal outcomes indicate that epidural analgesia is effective in reducing pain when compared to no epidural or opioid injections (Anim-Somuah, Smyth, Cyna, & Cuthbert, 2018; Sng et al., 2014). Side effects and complications include a longer first and second stage, more instrumental deliveries, but no neonatal adverse outcomes (Anim-Somuah, Smyth, Cyna, & Cuthbert, 2018; Grant, 2018; Sng et al., 2014). Epidural anesthesia users may also experience more hypotension, motor blockade, fever, and urinary retention necessitating more intervention to correct these side effects (Anim-Somuah, Smyth, Cyna, & Cuthbert, 2018; Grant, 2018). However, the issue is complicated by historical lack of clear evidence recommending use or avoidance of labor epidural analgesia (Wong, 2017; Sng et al., 2014).

There are many variables that effect labor outcomes and many ways to assess the interactions in evaluating the safety of epidural analgesia for the mother and baby. Depending on how the study was designed and the study population, different conclusions are reached. It is important that each individual practitioner read the current evidence and explain the information to patients in a way that in understandable and meaningful to them.

Significance to Nurse-Midwifery

Per the American College of Nurse-Midwives [ACNM] (2012), the nurse-midwifery model of care advocates for non-intervention in the absence of complications. Epidural analgesia being an intervention requires the nurse-midwife to assess the risk-benefit it could have on the labor outcomes. Equally important for nurse-midwives is advocacy for informed choice, shared decision-making, and the right to self-determination. It is the nurse-midwife's goal to provide accurate information and the woman's right to decide how to manage labor pain.

The mixed results of the research thus far indicate that epidural analgesia may or may not have an effect on labor progress, delivery mode and the neonatal outcome. Current knowledge about epidural analgesia allows the nurse-midwife to be strong advocate and health partner for the laboring woman. There are many factors that influence a woman's decision to request an epidural analgesia: personal expectations, support from caregivers, involvement in decision-making, age, socio-economic status, ethnicity, childbirth preparation, the physical birth environment, and medical interventions (Klomp, Manniën, de Jonge, Hutton, & Lagro-Janssen, 2014). These factors are dynamic and are influenced by each women's culture and availability of resources. The nurse-midwife is there to provide the most up-to-date information through skillful communication and understanding of factors that may influence patient's coping plan.

Theoretical Framework

Nursing theories are foundations of nursing care that explain the psychological tasks and needs of the patient. Therefore, it is important to base research and practice on nursing theories. Two nursing theorists who specialize in perinatal nursing are Reva Rubin and Ramona Mercer. Reva Rubin first developed a theory on maternal identity and role attainment in 1967, which was taken and expanded upon by Mercer, a student of Rubin (Noseff, 2014). Mercer's middle range

theory of maternal role attainment pertains to the woman's psychosocial preparation and adaption to motherhood. Although this theory originated from Rubin's theory, Maternal Role Attainment theory is the most widely used theory in perinatal care. While this theory mostly deals with mother-infant bonding, the attachment and role attainment goal starts before pregnancy and continues 12 months postpartum. The perception of birth experience is an important stage in developing attachment and successful motherhood role attainment. By reducing adverse environmental factors and promoting social support, the woman's sense of role attainment is increased. In this theory, the nurse-midwife's role is to help the mother develop a sense of self-efficacy (Noseff, 2014).

Rubin's theory, or framework as Sleutel (2003) called it, is the first theoretical framework in intrapartum nursing care. This theory details how the mother experiences pregnancy, birth, and psychological tasks that will help her attain successful motherhood role. Rubin describes the intrapartum task of the mother as seeking safe passage and giving of oneself. Seeking safe passage refers to the mother's knowledge and care-seeking behaviors to ensure safe delivery. Giving of self refers to the sacrifice mothers make to ensure safety of her baby. If this is the psychological task of the mother, then the nurse-midwife's actions, information and support should be directed toward enhancing this task so that the mother feels safe and supported.

Rubin believed that providing information to the laboring woman appeals to her cognitive awareness and self-image, which gives a sense of control and understanding of the situation to increase self-esteem. Providing information helps the mother make the right decision for herself and baby. Affirmation and appraisal support are of paramount importance in midwifery care. Whether the laboring woman decides to get an epidural or not, it is important that nurse-

midwives are affirming and validate her choices. Rubin also identified physical or instrumental support as equally important during labor care. Whether the patient has an epidural or not, nurse-midwives should strive to provide comfort care through physical support of the laboring woman via touch, positions, hydration and nutrition support so she can focus on the important task of giving birth (Sleutel, 2003).

Rubin's role attainment theory fits well with the midwifery care model in general and particularly in the intrapartum care. Events that occur during the birth process can have a major impact on the role development of the mother (Sleutel, 2003). Labor pain and its management is a small piece of a much bigger task of becoming a mother. It is important for the midwife to keep that in mind and not get caught up in individual tasks or events.

Summary

Labor epidural analgesia are used in many countries around the world. The effects of epidural analgesia on labor outcomes are still a debated subject and many countries are actively studying epidural analgesia. In this chapter, the discussion covered the purpose of the paper, which is to critically review the current research on the effects of labor epidural analgesia on laboring progress, mode of delivery and neonatal outcomes in international communities. It also discussed the need for this review as recent research on labor epidural anesthesia in different countries is contradicting as to its effect on labor outcomes. This research is important for the midwifery profession because the midwife is tasked with being knowledgeable on the current research in order to give evidenced-based information to patients, allowing patients to make informed decisions about their healthcare. The labor process is important for the mother-to-be patient and Rubin's Maternal Role Attainment theory was used to guide the nursing process of interacting with laboring women. Chapter two will discuss the methods used for this critical

appraisal of the literature, search strategies, inclusion and exclusion criteria, a summary of the number and types of research selected for review, and criteria for evaluating research studies.

Chapter II: Methods

The purpose of this chapter is to describe search strategies used to identify research studies, criteria for including or excluding research studies, summary of the number and types of studies selected for the review, and criteria used for evaluating research studies. The goal of this literature review and appraisal was to identify research studies and analyze them based on Dearholt and Dang (2012) criteria for appraisal. Each study was appraised on its applicability to the clinical question based on the purpose of the study, setting, study sample, design, results, conclusions, and recommendations.

Search Strategies

The purpose of this critical appraisal of the literature is to determine the impact of epidural analgesia on labor progress, mode of delivery, maternal and fetal outcomes. Search strategies used to identify research articles on labor analgesia and labor outcomes was limited to years 2013-2018. Epidural analgesia is a medication and therefore science based and continuously evolving. Epidural analgesia components and dosage have changed and advanced with experience and techniques. It was important to limit search articles to the last 5 years to find the most current research as this is specialty that is changing and evolving (Halpern & Silva, 2010). Data bases used were the Cumulative Index to Nursing and Allied Health Literature (CINAHL), PubMed MEDLINE, and Cochrane Database of Systematic Reviews. The search terms used included epidural effects on labor progress, epidural analgesia labor outcome, labor epidural and cervical dilation, intrapartum epidural analgesia, epidural versus non-epidural or no analgesia in labor, epidural effect on neonatal outcomes. Additionally, the references within the research studies were examined to find additional relevant articles.

Criteria for Inclusion or Exclusion

Inclusion. Inclusion criteria for the articles for this review included articles that addressed epidural analgesia and its effects on labor progress, mode of delivery, maternal and neonatal outcomes. Primary inclusion criteria was location of study; international studies were specifically searched for and included if it met inclusion criteria. An intentional attempt was made to find studies from every continent of the world and, more specifically, countries that have similar health care systems to the U.S. Experimental, quasi-experimental, non-experimental research studies with good to high quality were also included.

Epidural analgesia is an intervention often administered by anesthesiologist whereby labor and delivery care is provided by a midwife or obstetrician. Therefore, research articles from these providers were selected for this review. Articles published by specialty journals such as *Journal of Obstetrics and Gynaecology, Anesthesia & Analgesia,* and *Midwifery* were prioritized and selected when appropriate for this review. Studies that were adequately powered with sufficient sample size were also selected. Studies that state specific medication used for epidural were preferred for this appraisal review. Sample characteristics such as gestational age greater than 36wks, singleton, vertex presentation and otherwise healthy mother and baby were selected for review.

Exclusion. Exclusion criteria included studies published before 2013, not written in English or level IV or higher of evidence strength grade on the Johns Hopkins Research Evidence Appraisal Tool (Dearholt & Dang, 2012). Studies with low quality grading were also not included either. Studies that did not specify the type of epidural medication administered or did not state the inclusion/exclusion criteria for the study were also excluded. Study methods and measurement tools were critically examined. Studies that did not define measurements or standardized language (FHR nomenclature/Apgar) or studies that did not state how they defined

prolonged labor by what standard were excluded. No systematic reviews, meta-analysis, qualitative studies or expert opinion articles were included in this review. Research done in the U.S. was also excluded.

Summary of Selected Studies

Initial search was "epidural analgesia AND effect AND labor". This gave more results in all of the search engines listed above. In CINAHL, the input resulted in 297 articles. Search results were refined to peer reviewed and published in academic journals. Results dropped to 197 articles. When search results were limited to 2013-2018, the number of results significantly dropped to 106. In PubMed MEDLINE search engine, the term "epidural analgesia AND effect AND labor outcome resulted in 530 articles. Results were refined to publication dates in last 5 years and the total number was reduced to 130. The same search terms were put into the Cochrane Database of Systematic Reviews; seven articles were found under this search term. When the publication date was limited to the last five years, the results dropped to 6 articles. Three articles were found through the reference list in Cochrane Database of Systematic Reviews articles. After sifting through many articles and evaluating the strength of evidence, a total of 20 articles met the inclusion criteria and were selected for final review and appraisal. Of the 20 articles selected for this review, 4 were randomized controlled trial, 2 quasi-experimental and 14 were non-experimental or qualitative studies, including retrospective, prospective, cohort, and descriptive methods.

- Level I experimental studies (n=4)
- Level II, quasi-experimental studies (n=2)
- Level III, non-experimental studies (n=14)
- Level IV, clinical practice guidelines (n=0)

- Level V, non-research literature reviews and case studies (n=0)

Evaluation Criteria

The selected articles were evaluated for strength and quality using the Johns Hopkins Research Evidence Appraisal Tool. The strength of evidence was graded level I-V. Level I evidence was assigned to randomized controlled trials. Level II to quasi-experimental studies. Any non-experimental studies were assigned to level III by the appraiser. Quality of studies was assigned according to the criteria set by Johns Hopkins Research Evidence Appraisal Tool. Quality is rated as low, good or high quality depending on the sample qualities, consistence of results and recommendation and quality of conclusions (Dearholt & Dang, 2012). The strength of evidence of the articles appraised on this review mainly consistent of level III due to the nature of the subject being studied.

Summary

The University data bases of CINAHL, Science Direct, PubMed MEDLINE, and Cochrane Database of Systematic Reviews were used for this appraisal review of the current research on epidural analgesia during labor and its effects on labor progress, type of delivery, and maternal and fetal outcomes. Articles published between the years 2013-2018 were selected that evaluated epidural analgesia use during labor for women that had full term, singleton, and low risk pregnancy. Twenty articles were finally selected for final appraisal. Johns Hopkins Research Evidence Appraisal Tool (Dearholt & Dang, 2012) was used to assess the strength and quality of evidence.

Chapter III: Literature Review and Analysis

Synthesis of Matrix

A matrix format was used to organize the research studies and present major themes as they relates to epidural anesthesia's effect on labor progress, mode of delivery and neonatal outcomes. The matrix is organized to present data in this order. The column headings of the matrix are chosen to reflect and organize data from each research study in succinct manner. The heading used are study purpose, description of the sample population and setting, level of evidence and quality, study design, results, strengths/limitations, and implication for the clinical question (Appendix 1). The matrix organized the studies based on level and quality. The highest level and quality of study was listed first and were organized chronologically by year with the most recent articles listed first. The level of evidence and quality of each research study was appraised using the Johns Hopkins Research Evidence Appraisal tool (Dearholt & Dang, 2012). Studies with low quality and systematic reviews were excluded. The studies' pertinent findings are evaluated and synthesized in the following section.

Synthesis of the Major Findings

Twenty scholarly research articles were appraised in this review to determine the impact of epidural anesthesia on labor progress, mode of delivery and neonatal outcomes. Eleven studies addressed multiple aspects of labor, such as duration of labor in first and second stage, mode of delivery and neonatal effects of epidural anesthesia, since labor events and labor outcomes are intricately related. Two studies focused on labor progress in relation to epidural use. Three articles concentrated on mode of delivery, whether spontaneous vaginal delivery, operative vaginal delivery or cesarean section. Four articles examined epidural effects on neonate transition and breastfeeding concerns. The major themes that emerged from these studies were:

duration of first and second stage of labor, mode of delivery and newborn transition and breastfeeding in laboring women who used epidural anesthesia. The synthesis of major findings will address the results.

Labor duration

Patients and providers alike ask if epidural or regional anesthesia use during labor would affect duration of labor time in positive or negative time (Halpern & Silva 2010). The American College of Obstetricians and Gynecologist's [ACOG] (2017) position on epidural anesthesia is that it shortens the first stage of labor and slightly prolongs the second stage of labor. The international community of obstetric providers and studies show mixed results on the effect of epidural analgesia (Bannister-Tyrrell, Ford, Morris, & Roberts, 2014; Hasegawa, Farina, Turchi, Hasegawa, Zanello, & Baroncini, 2013; Shmueli et al., 2018). Mainly, this is due to the fact that labor management, epidural anesthesia dosage and concentration are different amongst provider and locations.

First stage labor duration. In this research review, seven studies evaluated the effect of regional anesthesia on labor progress and duration of the first stage of labor. The following three studies did not find an increase in duration of the first stage of labor. In Athens, Greece, an RTC (n=62) evaluating cervical dilation found that ropivacaine 0.2% plus 20 mcg of fentanyl did not affect cervical dilation and progress of the first stage of labor (p=.341) (Staikou, Kalampokas, Kalampokas, Vassiloglou, & Paraskeva, 2017). Similarly, Singh, Yahya, Misiran, Masdar, Nor, and Yee's (2016), prospective study found no significant difference in duration of labor in women receiving combined-spinal epidural (CSE) and no epidural group (p=0.718) when Ropivacaine 0.2% with Fentanyl 25mcg was given. Another RTC (n=100, p=<0.05)) in Turkey

found that epidural anesthesia shorted the first stage of labor (Genc et al., 2015). This study used a high concentration epidural dose of bupivacaine 0.5% with Fentanyl 50 mcg in 10cc saline.

In contrast, Hasegawa, Farina, Turchi, Hasegawa, Zanello, and Baroncini (2013) conducted a retrospective study in Italy (n=1750, OR 0.69, 95 % CI 0.59–0.79) that found epidural use prolonged the first stage of labor. The standard low concentration of ropivacaine 0.1 % with Sufentanil 10 mcg was used, which is an appreciably lower dose than used in preceding studies. Labor dystocia was diagnosed when no appreciable change in dilatation occurred for more than two hours in the active phase. Another retrospective study (Hung, Hsieh, & Liu, 2015) that had good quality evidence in Taiwan (n=16,852) found that that epidural anesthesia does increase duration of the first stage of labor. In the nulliparous women, epidural analgesia was a significant risk factor for operative vaginal delivery (adjusted OR 2.14, 95% CI 1.80-2.54), but it was a protective factor against caesarean delivery (adjusted OR 0.62, 95% CI 0.55-0.69) .

First stage labor complications. There are other concerns that could occur during the first stage of labor, such as maternal fever or maternal hypotension that could potentially lead to fetal distress and possibility cesarean delivery (Hasegawa, Farina, Turchi, Hasegawa, Zanello, & Baroncini, 2013). A prospective study, done in Sweden (n = 132, p<.0001), observed that epidural anesthesia had a significant increase in maternal and fetal temperature during labor by 07.-0.8 C above the normal range (Lavesson, Källén, & Olofsson, 2017). Epidural induced fever is associated with low Apgar score, neonatal hypotonia and need for assisted ventilation and early-onset of seizures (Lavesson, Källén, & Olofsson, 2017). It is important for the practitioner to recognize the source of fever and treat it appropriately. Furthermore, maternal hypotension could occur with epidural anesthesia necessitating interventions that could potentially affect the

course of the first stage of labor and delivery method. Patel et al., (2014) did a study (n=115, $p < 0.0001$) looking into the effects of epidural hypotension and abnormal FHR patterns. In their study, they concluded that abnormal FHR were observed with patients that received CSE anesthesia, but it did not affect the mode of delivery Apgar scores, cord PH or NICU admission.

Second stage. Shen et al., (2017) did an RCT study (n=400; *P*=.52) in an academic hospital in Nanjing China. All women started with an epidural and at the start of second stage (at 10cm dilation), the intervention group (n=200) had the epidural stopped and saline given. The control group (n=200) continued with the low concentration ropivacaine 0.08% with Sufentanil 0.4mcg/ml. Shen et al. (2017) determined that epidurals do not affect the duration of second stage. Labor was managed per hospital protocol and no specific organizational authority was mentioned in the study. This landmark study had the attention of the OB/GYN community because, up until this study, it was believed that epidural anesthesia prolonged the second stage of labor (Anim-Somuah, Smyth, Cyna, & Cuthbert, 2018; Grant, 2018; ACOG, 2017). Zhou, Gong, He, Gao, and Wang's (2017) retrospective cohort study in China (n=11994; p=0.789) observed no increase in duration of second stage with 0.1% ropivacaine with 0.5mcg/ml sulfentanyl. Another prospective study with high quality evidence by Singh, Yahya, Misiran, Masdar, Nor, and Yee (2016) in Brazil which also concurred that labor anesthesia does not increase duration of the second stage of labor (n=110; p=0.675).

Surprisingly, recent studies coming from Israel which has a health care similar to United States and uses the ACOG care guidelines and National Institute of Child Health and Human Development (NICHD) fetal monitoring language has come to different conclusions. A high-quality retrospective cohort study of 25,643 women showed that the second stage was longer for the epidural users, 94 min vs. 33min for non-users ($p =< 0.001$) with bupivacaine 0.1% with

fentanyl 2mcg/ml (Srebnik et al., 2019). Similarly, Shmueli et al., (2018) reported a longer second stage for epidural users by 82 minutes. (n=15500; p=0.000) Two other studies in Turkey and Taiwan also reported a longer second stage of labor with the use of epidural anesthesia. (n=100; p=<0.05) (Genc et al., 2015; Hung, Hsieh, & Liu, 2015).

Mode of delivery

The type of delivery, whether spontaneous vaginal delivery, assisted vaginal delivery (operative) or cesarean delivery, is most important to the practitioner and patient alike. Epidural anesthesia is a voluntary intervention introduced into labor with benefits and risks (Halpern & Silva 2010). One of the risks is its effect on mode of delivery. Eleven studies in this critical review showed that epidural anesthesia increased operative vaginal delivery and/or cesarean delivery. The following three studies reported that epidural use does not affect mode of delivery (Wassen, Hukkelhoven, Scheepers, Smits, Nijhuis, & Roumen, 2014; Staikou, Kalampokas, Kalampokas, Vassiloglou, & Paraskeva, 2017; Shen et al., 2017).

Instrumental delivery. Wassen, Hukkelhoven, Scheepers, Smits, Nijhuis, and Roumen's (2014) retrospective cohort study, conducted over 10-year period in the Netherlands (n= 1,378,458; p<0.001), observed epidural analgesia use during labor decreased the rate of instrumental delivery but slightly increased unplanned cesarean delivery, although the study did not mention the type of epidural analgesia used. Similarly, two RCT (Staikou, Kalampokas, Kalampokas, Vassiloglou, & Paraskeva, 2017; Shen et al., 2017) studies did not observe increase in instrumental delivery (n=62; p>0.05; n=400; p=0.17). Furthermore, a study by Singh, Yahya, Misiran, Masdar, Nor, and Yee (2016; n=110; p=0.917) showed no increase in instrumental delivery.

A European study by Lucovnik, Blajic, Verdenik, Mirkovic, and Stopar Pintaric (2018) in Slovenia (n=207,525; p=<0.003) reported higher rates of instrumental and cesarean deliveries with epidural use. Epidural analgesia used was high local anesthetic concentrations without fentanyl, leading to the higher likelihood of motor block. Adams, Frawley, Steel, Broom, and Sibbritt (2015) also reported similar results with an increased risk for instrumental delivery. Their study was done in Australia (n=1835; p=<0.001). Four other studies in this review reported epidural anesthesia increased risk for instrumental delivery (Hasegawa, Farina, Turchi, Hasegawa, Zanello, & Baroncini, 2013, (n=350; p=<0.001); Srebnik et al., 2019 (n=25,643; p=<0.001); Genc et al., 2015 (n=100; p=0.032); Hung, Hsieh, & Liu, 2015. (n=16,852; adjusted OR 2.14, 95% CI 1.80-2.54)). Low concentration epidural anesthesia was used in these studies except Genc et al. (2015) where high concentration 0.5% bupivacaine was used.

Cesarean section delivery. Two studies looked specifically at the risk for cesarean section when epidural anesthesia is used while in labor. Bannister-Tyrrell, Ford, Morris, and Roberts (2014) in South Wales Australia did a cohort study (n=210,708) to determine the risk for cesarean delivery when epidural anesthesia is used. In this study, epidural analgesia increased the relative risk of cesarean delivery by 2.5 fold (95% CI 2.5, 2.6) and the absolute risk by 11.9%. Another study by Rukewe, Adebayo, and Fatiregun (2015, n=21) found slightly increased risk for cesarean delivery for nulliparous women when they used epidural anesthesia, but it was not statistically significant (p=<0.07). Another study in this review by Lucovnik, Blajic, Verdenik, Mirkovic, and Stopar Pintaric (2018, (n=207,525; p=<0.003) looked at cesarean rates in women receiving an epidural. Results showed a slight increased risk for cesarean delivery while Wassen, Hukkelhoven, Scheepers, Smits, Nijhuis, and Roumen (2014, (n=1,378,458; p=<0.001) found a decrease in cesarean deliveries. Conversely, the RCTs in this review indicate that epidural

anesthesia does not increase the risk for cesarean delivery (Staikou, Kalampokas, Kalampokas, Vassiloglou, & Paraskeva, 2017, (n=62; p>0.05); Shen et al., 2017, (n=200; p=<0.05); Singh, Yahya, Misiran, Masdar, Nor, & Yee, 2016. (n=110; p=0.917).

Vaginal trauma. Two studies looked at other events that are said to occur with epidural anesthesia during second stage of labor. Zhou, Gong, He, Gao, and Wang (2017) did a study to assess the incidence of episiotomy with women delivering with combined spinal-epidural analgesia. The study had a large sample, n=11,994 and found the incidence of episiotomy was higher in the CSEA group but when adjusted for maternal age, gestational age, infant birth weight and prolonged second stage of labor, it was found that CSEA did not increase the risk of episiotomy (adjusted OR 1.080, 95% CI 0.988–1.180). Garcia-Lausin, Perez-Botella, Duran, Rodríguez-Pradera, Gutierrez-Martí, and Escuriet (2019) did a study (n=5,497) in Spain which looked at the relationship between epidural (bupivacaine 0.0625% with fentanyl) use and severe perineal laceration (SPL) involving the anal sphincter (third and fourth degree). They found that the use of EA was not a risk factor for SPL neither in spontaneous nor in instrumental birth (OR 0.47 CI 95%: 0.21–1.02, *p*: 0.060; OR 0.45 CI 95% 0.94–2.11, *p*: 0.310) respectively.

Neonatal outcomes

Epidural analgesia's effect on labor outcomes has received much attention in the research community. However, there has not been adequate studies or consensus on the effect of labor epidural analgesia on the neonate immediately after birth and breastfeeding (French, Cong, & Chung, 2016). Apgar score, admission to NICU and breastfeeding initiation are good measures of the wellbeing of the neonate.

A study by Herrera-Gómez, García-Martínez, Ramos-Torrecillas, De Luna-Bertos, Ruiz, and Ocaña-Peinado (2015) did a study(n=2,399) in Spain that assessed the association between

epidural analgesia use and the neonatal outcome. They found lower mean Apgar score at one and five minutes with epidural group ($p<0.0001$). NICU admission was 8.2% with epidural groups versus 4.6% of non-epidural group ($p=0.003$). Resuscitation was required by 28.7% in epidural group vs. 17.6% in the other group. Early breastfeeding initiated by 82.4% of epidural group and 91.1% of non-epidural group. Orbach-Zinger et al. (2018) in Israel examined duration of breastfeeding at six weeks postpartum on women (n=1,204) with epidural anesthesia-bupivacaine 0.1% with fentanyl. They found breastfeeding rates at 3 days and at 6 weeks were significantly lower among women delivering with epidural analgesia (odds ratio [OR], 0.60; 95% CI, 0.40–0.90; P = .015). Other studies in this review also noted a negative impact of epidural anesthesia on the neonate. Adams, Frawley, Steel, Broom, and Sibbritt (2015) found women who required an epidural were more likely to have their baby admitted to a special care nursery (n=1835; $p<0.001$), compared to women who did not require an epidural, and less likely to continue breast-feeding beyond six weeks ($p=0.006$). Hung, Hsieh, and Liu (2015) and Rukewe, Adebayo, and Fatiregun (2015) found lower ,7 1-minute Apgar score on mothers receiving epidural anesthesia (n=16,852; $p=0.009$; n=21; $p=0.03$).

In contrast, a study done in India by Shrestha, Devgan, and Sharma (2014) on epidural anesthesia administration during labor did not affect neonatal breastfeeding initiation (n=200; $p=0.60$). Shen et al., 2017 (n=100; $p=0.62$). Singh, Yahya, Misiran, Masdar, Nor, and Yee (2016) (n=110) and Genc et al., (2015) (n=100) found no statistically significant difference in Apgar scores in women who received epidural and those that did not.

Strengths and Weaknesses

There are many strengths for this review. Study samples were large enough to draw firm conclusions. Many studies were observational giving ample time to study the subject well. Most

of the studies explored factors that could affect the outcome, such as labor duration, maternal characteristics and delivery methods. Studies in this review only selected healthy women with normal pregnancy to study. The studies did well in controlling for confounding factors, such as oxytocin use, fetal weight, instrumental delivery, and parity. All the studies were peer reviewed with high to good quality except for one study with low quality. Studies with evidence level I-III were selected for this review.

The limitation of this review is the nature of the review. This review was intended to study international experience of women receiving epidural anesthesia during labor. No two facilities are exactly same in administering health care much less than in international setting. No standard language or definitions for labor assessment was found between studies. Many studies in this review stated that hospital specific standard protocols were used for labor management. Most of the studies in this review were done in a single facility with similar ethnic women; therefore, the studies suffer from lack of generalizability or external validity. Furthermore, the results observed in these studies were associations only. Associations are not necessarily causation. Most of the studies called for further studies into associations observed and for randomized control trials.

Summary

This chapter synthesized major findings of the review. Twenty articles were appraised and reviewed. Major themes that emerged were effects on labor duration, mode of delivery and neonate. They were discussed and compared and contrasted with other studies. Studies were organized around events of labor, such as progress of labor in first and second stage, complications of labor, mode of delivery and effects on neonatal outcomes.

Labor duration in the first stage was shorter for women receiving epidural anesthesia, according to RTCs and high-quality non-experimental studies in this review. In contrast, the second stage of labor was longer for women receiving labor analgesia. Epidural's effect on mode of delivery was also assessed. Most of the studies indicate increased incidences of instrumental delivery and risk for cesarean delivery was conflicting with some studies showing increased risk while others showed decreased risk for cesarean delivery. Neonatal outcomes were also evaluated. Apgar scores, NICU admission and breastfeeding rates were negatively affected in the presence of epidural analgesia per most of the studies reviewed in this paper.

Chapter four will discuss further the research findings of this review and synthesis of the literature answering the research question, current trends and gaps in the literature, implications for nursing education and recommendations for further nursing research.

Chapter IV: Discussion, Implications and Conclusions

The purpose of this research literature review was to assess the impact of epidural anesthesia on labor progress, mode of delivery and neonatal outcomes. Twenty research studies were critically appraised using the Johns Hopkins Research Evidence Appraisal Tool. This evaluation of these studies revealed the implications for nurse-midwifery as well as the limitations of the current literature. This chapter will discuss the research findings' implications of nurse-midwifery practice and opportunities for future research will be discussed. The chapter will conclude with the integration of Rubin's Maternal Role Attainment theory in helping laboring women become self-efficacious in their birth experience and impact of epidural analgesia intervention.

Literature Synthesis

The research question for this critical review was aimed to find if epidural analgesia effects labor progress, mode of delivery, and neonatal outcomes in the international community. The current international research on the effects of labor epidural shows mixed evidence, both positive and negative impact on labor and birth outcomes. Major themes that emerged in this literature review were the effect of epidural analgesia on labor duration in first and second stage, altered mode of delivery and neonatal transition to extrauterine life. The details of each of these would be expanded further in the following section.

Trends and Gaps in the Literature

In order to understand the evidence reported in this review, it is important to understand the terminology and standard protocols regarding epidural analgesia administration. It is also noteworthy that labor management and assessment is different in different settings around the world, in specific hospitals, and even from provider to provider. Therefore, each study was

evaluated for the type of medication used and labor management protocol, if such was stated in the study.

It has been hypothesized and showed in research that negative effects of epidural analgesia are dose dependent with higher concentration of local anesthesia associated with unwanted effects (Halpern & Silva 2010; d'Arby Toledano & Leffert, 2018; Grant, 2018).The potential mechanisms by which epidural analgesia would affect labor include pelvic floor muscle relaxation, motor blockade, decreased maternal expulsion efforts and altered maternal hormones via catecholamines (Halpern & Silva Grant, 2018; Shen et al., 2017).

Continuous epidural and combined spinal-epidural (CSE) are the most commonly used neuraxial techniques for labor analgesia (d'Arby Toledano & Leffert, 2018). CSE is the preferred method for some anesthesiologists for its rapid pain relief and no additional risks associated with this technique when compared to other neuraxial techniques (Halpern & Silva 2010; d'Arby Toledano & Leffert, 2018).

Medication. The drugs used for neuraxial labor analgesia techniques usually include a combination of dilute local anesthetic and lipid-soluble opioid (fentanyl or sufentanil). The current literature recommends using the lowest concentration of local anesthetic and opioid that provides effective maternal analgesia with minimal adverse effects (Halpern & Silva 2010; d'Arby Toledano & Leffert, 2018). Commonly used standard low concentration epidural analgesia concentrations are 10-20-mL bolus of 0.0625 to 0.1% bupivacaine or ropivacaine 0.08 to 0.15%, most commonly with a lipid-soluble opioid fentanyl 1 to 3 mcg/mL or sufentanil 0.2 to 0.5 mcg/mL of local anesthetic solution (d'Arby Toledano & Leffert, 2018). A bupivacaine dose of 0.25% or higher is considered a high-concentration (Halpern & Silva 2010). CSE dosing

ranges 1.25 to 3.0 mg bupivacaine or 1.25 to 3.0 mg ropivacaine combined with 10 to 15 mcg fentanyl or 2.5 to 5 mcg sufentanil (Halpern & Silva 2010; d'Arby Toledano & Leffert, 2018).

First stage of labor duration. Three studies did not find an increase in duration of the first stage of labor (Staikou, Kalampokas, Kalampokas, Vassiloglou, & Paraskeva, 2017; Singh, Yahya, Misiran, Masdar, Nor, & Yee, 2016; Genc et al., 2015). When low concentration epidural analgesia is used, studies found no significant difference in the duration of the first stage of labor (Staikou, Kalampokas, Kalampokas, Vassiloglou, & Paraskeva, 2017; Singh, Yahya, Misiran, Masdar, Nor, & Yee, 2016; Genc et al., 2015) Epidural anesthesia controls labor pains well and therefore, leads to rapid decrease in circulating catecholamines and increased uterine contractions, which could potentially decrease duration of the first stage (Genc et al., 2015; Grant, 2018). However, two studies did find that epidurals prolong the first state of labor (Hasegawa, Farina, Turchi, Hasegawa, Zanello, & Baroncini, 2013; Hung, Hsieh, & Liu, 2015). Even though these studies used low concentration epidural anesthesia, they were observational in design and the findings are more associations than causation. Evidence appraisal shows that randomized controlled trials (RCT) rank highest in research evaluation (Dearholt & Dang, 2012). In upholding this method of research appraisal, the evidence presented and appraised supports that epidural anesthesia does not increase the duration of first stage of labor.

Second stage of labor duration. As with the first stage, studies results are mixed. Three studies (Shen et al., 2017; Zhou, Gong, He, Gao, & Wang, 2017; Singh, Yahya, Misiran, Masdar, Nor, &Yee, 2016) reported that regional anesthesia did not increase the duration of second stage. However, four other studies in this review showed longer second stage for epidural use (Srebnik et al., 2019; Shmueli et al., 2018; Genc et al., 2015; Hung, Hsieh, & Liu, 2015).

Epidural analgesia has been thought to prolong the second stage of labor by removing the parturient involuntary bearing down reflex, or by interfering with motor function. Poor maternal effort at expulsion may cause fetal malposition during descent, which may lead to intervention in the form of instrumental delivery or cesarean delivery. However, in modern-day practice when dilute local anesthetic solutions are used to provide epidural analgesia, the motor blockade and hence weakness of pelvic floor muscle, is either minimal or absent (Staikou, Kalampokas, Kalampokas, Vassiloglou, & Paraskeva, 2017; Singh, Yahya, Misiran, Masdar, Nor, & Yee, 2016). This was confirmed by a recently published meta-analysis on the effect of low concentrations versus high concentrations of local anesthetics for labour analgesia on obstetric and anesthetic outcomes (Wang, Sun, & Huang, 2017).

It is difficult to state categorically whether epidural anesthesia causes a longer second stage of labor in light of the present studies, especially when considering the differences in health care amongst international communities. The research community has a bias in favor of RCTs. RCTs showed no increase in duration of second stage. However, high quality studies with large sample sizes, although non-experimental in design, have reported increases in the second stage of labor with epidural use. Due to the nature of the subject in interest, in this case epidural anesthesia during labor, it is difficult to design large scale RCTs due to the ethics involved. Non-experimental studies are often the source of nursing information, according to Dearholt and Dang (2012). Therefore, it is conceivable that epidural anesthesia use does prolong the second stage of labor even though the evidence supporting it is not highest level of quality.

Labor complication. Other complications could potentially arise due to epidural analgesia use during labor. Lavesson, Källén, and Olofsson (2017) observed epidural anesthesia had a significant increase in maternal and fetal temperature during labor by 07.-0.8 C above the

normal range. Fever during labor is associated with low Apgar score, neonatal hypotonia and need for assisted ventilation and early-onset of seizures (Lavesson, Källén, & Olofsson, 2017). It is important for the practitioner to recognize the source of fever and treat it appropriately. Furthermore, maternal hypotension could occur with epidural anesthesia necessitating interventions that could potentially affect the course of labor and delivery method. Patel et al., (2014) reported hypotension and abnormal FHR patterns when epidural anesthesia was used but these abnormal FHR did not affect mode of delivery or neonate.

Mode of delivery. Different local anesthetics may have different effects on the progress and outcome of delivery. The concentration of the epidural anesthetic is important; increased concentrations of ropivacaine has been associated with a high incidence of instrumental deliveries (Halpern & Silva 2010; d'Arby Toledano & Leffert, 2018). Therefore, each study in this review was assessed for the type of anesthesia used and strength of each drug. Two observational studies (Adams, Frawley, Steel, Broom, and Sibbritt, 2015; Lucovnik, Blajic, Verdenik, Mirkovic, & Stopar Pintaric, 2018) reported that epidural analgesia increased instrumental and cesarean deliveries. These two studies did not specify the medication dose or concentration used and therefore cannot be generalized into practice or compared to the other studies. Several other studies (Srebnik et al., 2019; Shmueli et al., 2018; Genc et al., 2015; Hung, Hsieh, & Liu, 2015; Hasegawa, Farina, Turchi, Hasegawa, Zanello, & Baroncini, 2013) in this review with good quality, although observational in design, found that low concentration epidural analgesia increased the risk for instrumental delivery but not for cesarean section. In these studies, instrumental or operative delivery were indicated because of prolonged second stage using Friedman's curve (Shmueli et al., 2018). However, contemporary obstetric

characteristics require us to adapt to newer portograms and to give the second stage of labor more time and spontaneous delivery (Shmueli et al., 2018).

Vaginal trauma. It is important for patients to know if epidural analgesia use will increase the risk for vaginal trauma. Studies that addressed this issue were purposely searched for this literature review. Two studies investigated whether there was an increased risk for vaginal trauma or protection against trauma when epidural analgesia is used. Zhou, Gong, He, Gao, and Wang's (2017) study did not find increased risk for an episiotomy when epidural analgesia is administered. Other researchers looked in epidural analgesia for increased risk for severe perineal laceration such as third or fourth degree vaginal lacerations. Garcia-Lausin, Perez-Botella, Duran, Rodríguez-Pradera, Gutierrez-Martí, and Escuriet (2019) did not find such associations between epidural use and severe perineal laceration.

Neonatal outcome. Epidural anesthesia can impact the neonate's Apgar score, NICU admission and breastfeeding habits (Herrera-Gómez, García-Martínez, Ramos-Torrecillas, De Luna-Bertos, Ruiz, & Ocaña-Peinado, 2015; Orbach-Zinger et al., 2018; Adams, Frawley, Steel, Broom, and Sibbritt, 2015). This can happen via a direct pharmacological effect on the newborn or placental transference of the maternally-administered epidural medications, as well as indirect effects due to physiological changes induced in the mother by the drug, including hormonal changes and decrease in blood pressure and body temperature (Lavesson, Källén, & Olofsson, 2017; Orbach-Zinger et al., 2018; Hung, Hsieh, & Liu, 2015; Herrera-Gómez, García-Martínez, Ramos-Torrecillas, De Luna-Bertos, Ruiz, & Ocaña-Peinado, 2015; Adams, Frawley, Steel, Broom, and Sibbritt, 2015). In this review, the most robust evidence supports delayed initiating and duration in breastfeeding with intrapartum epidural anesthesia administration (Orbach-Zinger et al., 2018).

Implications for Nurse-Midwifery Practice

The use of epidural analgesia moves the patient to a higher risk category, including requirement for continues monitoring, IV fluids, bladder catherization and decreased mobility (Newnham, McKellar, & Pincombe, 2016). Understanding the risks and benefits associated with epidural analgesia enables the nurse-midwife to counsel women and their families so that they are able to make informed consent and shared decision making. Some of the fundamental skills a nurse-midwife brings to patients are: advocacy of non-intervention in normal processes in the absence of complications, incorporation of scientific evidence into clinical practice, advocacy for informed choice, shared decision making, and the right to self-determination, therapeutic value of human presence, and collaboration with other members of the interprofessional health care team (American College of Nurse-Midwives, 2012). These are excellent skills nurse-midwives can use as a guide when assisting women when deciding on the use of epidural analgesia during labor.

Recommendations for Future Research

Epidural analgesia in obstetrics is an ever-changing field with new techniques and drugs. Research needs to keep up with it. Current research in the international community is lacking rigorous randomized control trials that furthers what we know about the fetal and neonatal effect of anesthesia in short and long term. We know the course of labor and delivery method can have an impact on how well the neonate transitions; randomized control trials can give us more definitive answers on how epidural analgesia and these factors interact.

Many of the studies reviewed here called for randomized control trials to quantify the causal relationship between epidural analgesia and labor events and outcomes. For example, Lucovnik, Blajic, Verdenik, Mirkovic, and Stopar Pintaric (2018) observed request for epidurals

may be a marker of dysfunctional (prolonged or obstructed) labor since women with complicated labors are more likely to require more efficient analgesia. Future studies on the characteristics of women requesting epidural should be performed further since preventing primary cesarean delivery is a very important goal.

Other researchers call (Shmueli et al., 2018; Zhou, Gong, He, Gao, & Wang, 2017; Shen et al., 2017) for further research and studies on epidural medication formulations and techniques and its effect on labor. It would be difficult to reach any firm conclusion with much variations in clinical practice and labor management strategies, especially in the international community. Therefore, it is a worthy ambition to standardize language and clinical practice in the presence of epidural analgesia and labor management, such as defining protracted labor or prolonged labor.

Theoretical Framework: Maternal Role Attainment

Maternal Role Attainment theory is the most widely used theory in perinatal care (Noseff, 2014). The World Health Organization's [WHO] (2018) recent study on maternal analgesia effects acknowledges that maternal experience of labor is important to the process of becoming a mother and encourages providers to provide a positive experience even in the presence of interventions such as epidural anesthesia. Events that occur during the birth process can have a major impact on the role development of the mother (Sleutel, 2003). While Maternal Role Attainment Theory mostly deals with mother-infant bonding, the attachment and role attainment goal starts before pregnancy and continues 12 months postpartum. The perception of the birth experience is an important stage in developing attachment and successful motherhood role attainment. By reducing adverse environmental factors and promoting self-efficacy, the woman's sense of role attainment is increased. In this theory, the nurse-midwife's role is to help the mother develop a sense of self-efficacy (Noseff, 2014). The nurse-midwife can achieve this

by providing accurate information about labor analgesia and its effect on labor progress and outcome so that the patient can make an informed choice. Patients' choices would be supported and birth experiences that are satisfactory to the patient would be promoted in the care of nurse-midwives. The ultimate goal for the nurse-midwife is to facilitate a birth experience that is empowering to the woman and her family.

Conclusion

In this critical review of the current international research on epidural analgesia and its' effect on labor and birth outcomes, several themes emerged: Duration of labor in the first and second stage, complications of labor; mode of delivery, and neonatal outcomes. Twenty research studies were critically appraised using the Johns Hopkins Research Evidence Appraisal Tool. Evidence supports that epidural analgesia controls labor pain well, and that in turn could help shorten the first stage of labor. The second stage of labor duration, in relation to epidural anesthesia, is not as clear. Some studies show epidural analgesia prolongs the second stage while others maintain it has no effect on the second stage of labor. The studies are not comparable as the same medications are not used. Other complications reported with epidural analgesia use were materteral and fetal fever. Maternal hypotension was also observed in some studies, although no lasting effect was observed. Recent high-quality evidence supports when low-concentration epidural anesthesia with opioid is used it has no effect on the second stage of labor or mode of delivery. On the mode of delivery, most of the studies agree that epidurals do not increase the risk for cesarean delivery. However, good evidence supports increased risk for instrumental delivery. Epidural analgesia is not associated with increased risk for vaginal trauma. The studies do not agree on the neonatal effect of epidural analgesia. A very generalized consensus is that epidural analgesia does not have an impact on Apgar scores. Some studies

show epidural analgesia effects breastfeeding initiation duration. Any effect of epidural analgesia cannot be generalized to other populations without knowing the medication dosage and strength and labor management protocol being used.

It is important for nurse-midwives to understand the variation in epidural anesthesia medication and its reported effects. The nurse-midwife also understands that epidural analgesia is an intervention with both positive and negatives effects. It is the duty of the nurse-midwife to help the patient understand this. Furthermore, the nurse-midwife can use the Maternal Role Attainment Theory as a guide to assist patients with informed choice and shared decision making. There is definitely room for further research. In the research presented here, authors call for more randomized control trials to study the effects of epidural analgesia and some standardization on the protocols used. This author would like to see more rigorous, long term studies to assess the effects of epidural analgesia on the neonate.

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Source:
Shen, X., Li, Y., Xu, S., Wang, N., Fan, S., Qin, X., ... & Hess, P. E. (2017). Epidural Analgesia During the Second Stage of Labor: A Randomized Controlled Trial. *Obstetrics & Gynecology*, *130*(5), 1097-1103. doi: 10.1097/AOG.0000000000002306

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To evaluate epidural analgesia infusion's effects on the duration of the second stage of labor in nulliparous laboring women compared with a placebo control. **Sample:** 200 in control and 200 in intervention group (epidural stopped in second stage of labor) of healthy nulliparous, singleton, vertex, >37wks gestation presented in spontaneous labor and desired epidural analgesia. **Setting:** Hospital in Nanjing, China. **Level of evidence: I** **Quality of evidence: Good**	RCT At full cervical dilation, patients were randomly assigned to receive low concentration of Ropivacaine 0.08% with Sufentanil 0.4mcg/ml epidural or normal saline (the placebo). Primary outcome: Duration of second stage of labor, calculated in minutes from full cervical dilation until delivery. Secondary outcomes measured were pain scores using visual analog scale, motor block measured using modified Bromage Score, patient satisfaction with labor analgesia was assessed using Likert scale, mode of delivery, episiotomy, fetal position at delivery (occiput presentation), neonatal Apgar score and umbilical blood gas (lab measurement of umbilical artery pH and acid base values).	Duration of second stage of labor similar in both groups *P*=.52. No statistical differences pain scores between groups. Satisfaction with labor analgesia was lower in placebo group (*P*<.001). No difference in fetal head presentation positions in both groups (*P*=.98). Similar rates of cesarean deliveries, forceps deliveries and episiotomies in both groups. There were no significant differences in neonatal outcomes. Spontaneous vaginal delivery rate similar in both groups (P=.17). **Conclusion:** Epidural analgesia does not affect the duration of second stage. Maternal and neonatal outcomes were similar in both groups with exception of lower labor analgesia satisfaction rate in placebo group	**Strengths:** RCT design **Limitations:** Comparing women who had received epidural already but turned off at the second stage for the intervention group.

Author Recommendations:
More RTC studies at different facilities.

Summary for current clinical practice question:
Turning off epidural at second stage does not affect duration of second stage, maternal or neonatal outcomes according to this study.

Source:
Staikou, C., Kalampokas, T., Kalampokas, E., Vassiloglou, S., & Paraskeva, A. (2017). Epidural fentanyl does not affect cervical dilation and progress of first stage of vaginal delivery: A randomized, double-blind study. *Current Medical Research and Opinion*, *33*(8), 1491–1496. doi:10.1080/03007995.2017.1321536

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: Investigate if fentanyl added to epidural ropivacaine can affect cervical dilation and progress of vaginal delivery **Sample:** Nulliparous women with uncomplicated pregnancies with singleton, >38 weeks' gestational age, cephalic presentation, 3-4 cm dilated with normal FHR/Toco tracing and anticipated vaginal delivery without any no other analgesics. **Setting:** Athens, Greece **Level of evidence: I** **Quality of evidence: Good**	RCT Participants were randomized to receive epidural either ropivacaine with fentanyl (n=31) or ropivacaine with normal saline (n=31)-control. Primary outcome: time to full cervical dilation (10 cm). Secondary outcomes: Mode of delivery, Bishop scores, ropivacaine consumption, pain intensity and satisfaction, maternal adverse effects, neonatal Apgar scores and complications.	The incidence of normal vaginal deliveries, instrumental assisted vaginal deliveries, or cesarean deliveries did not differ significantly between the groups ($p > .05$. Time to reach 10 cm cervical dilation did not differ between the two groups: it was 4 ± 2.4 h in the fentanyl group vs 4.4 ± 2.1 h in the control group (p=.341). Significantly lower pain scores p= .01 and significantly higher satisfaction scores p =.001. No other differences in secondary outcomes. **Conclusion:** The addition of fentanyl to ropivacaine 0.2% solution did not affect cervical dilation and progress of the first stage of labor but improved both analgesia and satisfaction.	**Strengths:** RCT **Limitations:** Intermittent epidural bolus. Study not comparable to continues epidural or patient controlled epidural.

Author Recommendations:
Study with true control group with no epidural.

Summary for current clinical practice question:
Fentanyl addition to epidural anesthesia does not affect first stage duration.

Source:
Genc, M., Sahin, N., Maral, J., Celik, E., Kar, A. A., Usar, P., … Guclu, S. (2015). Does bupivacaine and fentanyl combination for epidural analgesia shorten the duration of labour? *Journal of Obstetrics and Gynaecology, 35*(7), 672–675. doi:10.3109/01443615.2014.991299

Purpose/Sample	Design (Method/Instruments)	Results	Strengths/Limitations
Purpose: To explore the effects of epidural analgesia of combination of low-dose bupivacaine and fentanyl on mother, fetus and labor duration in nulliparous women. **Sample:** 100 nulliparous, healthy women with singleton cephalic presentation pregnancies of 37-41wks gestation. **Setting:** Sifa University, Department of Gynecology and Obstetrics in Izmir, Turkey **Level of evidence: I** **Quality of evidence: Good**	Prospective randomized controlled trial. 47 epidural, 48-no epidural, 3 had C-section and excluded from study. Primary outcomes: Labor duration in first and second stage. Secondary: Apgar scores, operative delivery, N/V, tremors and sedation.	First stage of labor was significantly less in the epidural analgesia group (217.9 ±166.33 min). Second stage of labor was significantly long in the epidural analgesia group (29.6 ± 43.0 min). The rates of vomiting, nausea, tremor, vacuum-assisted and instrumental delivery were highest in the epidural analgesia group ($p < 0.05$). No differences between the two groups in Apgar scores. **Conclusion:** Epidural shortens first stage, lengthens second stage and increases instrumental delivery.	**Strengths:** RCT **Limitations:** Small sample.

Author Recommendations:
Adding Fentanyl to epidural helps with pain control better than just anesthetic. Decreased adrenaline leads to increased uterine contractions.

Summary for current clinical practice question:
Epidural shortens first stage, lengths second stage and increases instrumental delivery.

Source:
Patel, N. P., El-Wahab, N., Fernando, R., Wilson, S., Robson, S. C., Columb, M. O., & Lyons, G. R. (2014). Fetal effects of combined spinal-epidural vs epidural labour analgesia: A prospective, randomised double-blind study. *Anaesthesia, 69*(5), 458–467. doi:10.1111/anae.12602

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: Compare FHR patterns, Apgar scores and umbilical cord gas values following initiation of labor analgesia using either combined spinal-epidural or epidural. **Sample:** 115 women. Inclusion criteria of singleton pregnancy of>36 weeks gestation with vertex presentation, and in active labor between 2 and 6 cm cervical dilatation. **Setting:** London, UK **Level of evidence: I** **Quality of evidence: Good**	RCT Outcome measured fetal heart rate patterns, Apgar scores and umbilical cord gas values following initiation of labor analgesia using either combined spinal-epidural or epidural. Combined Spinal-Epidural (CSE) group received 2.5 ml of a mixture of bupivacaine 0.1% with fentanyl 2ug/ml. Epidural group received 20 ml bupivacaine 0.1% with fentanyl 2ug/ml. They were monitored with EFM for 60min after medication was given	There was significant reduction in FHR accelerations rate and increase in decelerations after neuraxial analgesia. Within groups, there was a significant increase in the number of abnormal (suspicious or pathological) FHR traces after neuraxial analgesia. No difference seen between the two groups in mode of delivery Apgar scores, cord PH or NICU admission. **Conclusion:** There were no differences in FHR patterns between groups but severe hypotension needing treatment was observed in CSE group more often.	**Strengths:** RCT design **Limitations:** Compares CSE to epidural only. Monitoring was only for 60min.

Author Recommendations:
Further research is needed comparing CSE, epidural and parental opioids.

Summary for current clinical practice question:

Type of epidural (CSE vs. Epidural) does not affect mode of delivery Apgar scores, cord PH or NICU admission. FHR abnormalities were observed in both groups. CSE had more frequent hypotension events.

Source:
Singh, S. K. S. C., Yahya, N., Misiran, K., Masdar, A., Nor, N. M., & Yee, L. C. (2016). Combined spinal–epidural analgesia in labour: Its effects on delivery outcome. *Brazilian Journal of Anesthesiology* (English Edition), *66*(3), 259–264. doi:10.1016/j.bjane.2014.09.006

Purpose/Sample	Design (Method/Instruments)	Results	Strengths/Limitations
Purpose: To determine the effects of Combined spinal-epidural (CSE) analgesia on labor outcome. **Sample:** 110 healthy women ages 20-40yrs, >37wks, cephalic in active labor (3-4cm) **Setting:** Brazil **Level of evidence:** II **Quality of evidence:** High	Quasi-experimental Fifty-five women in CSE group and 55 women in non-CSE group with no epidural. Labor management was similar in both groups. Outcome measured included duration of the first and second stages of labor, oxytocin augmentation, labor outcome (spontaneous vaginal delivery, instrumental vaginal delivery or cesarean section) as well as 1 and 5min Apgar scores.	No statistically significant differences in first and second stages of labor in both groups. Oxytocin augmentation was 71%in CSE and 65% in non-CSE groups. Spontaneous and instrumental vaginal delivery were not statistically different between the groups. Rate emergency cesarean section(c/s) did not significantly differ between the two groups. Fetal distress indication for c/s for slightly higher with CSE groups. No statistically significant differences in Apgar scores between the two groups. **Conclusion:** No significant difference in the duration of labor, instrumental vaginal delivery and emergency c/s, and neonatal outcome in CSE compared to non-CSE group.	**Strengths:** Well designed, good discussion on labor management protocol. **Limitations:** No blinding and therefore, providers may have intervened CSE patients. Generalizability of the study to other patients, locations.

Author Recommendations:
Epidural analgesia should not be withheld in fear of poor outcomes.

Summary for current clinical practice question:

CSE does not increase labor duration, instrumental delivery or neonatal outcomes.

Source:
Shrestha, B., Devgan, A., & Sharma, M. (2014). Effects of maternal epidural analgesia on the neonate. A prospective cohort study. *Italian Journal of Pediatrics, 40*(1). doi:10.1186/s13052-014-0099-x

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To study the immediate effects of epidural analgesia in the newborns born to mothers with epidural analgesia and compared with the newborns born to mothers without epidural analgesia. **Sample:** N-200 mothers. 100 case and 100 control, term, low risk pregnancy. **Setting:** Tertiary care teaching hospital in Maharashtra University of Health Sciences, Nashik, India **Level of evidence: II** **Quality of evidence: Good**	Quasi-experimental 100 (case) women given epidural 10 ml of 0.125% bupivacaine & 20 mcg fentanyl at maternal request compared to 100 (control) women who did not receive epidural. Outcomes measured: Passage of urine, onset of breast feeding, birth asphyxia and instrumental delivery. Statistical analysis was done using the software Epi Info 3.5.1. P value of <0.05 was considered as statistically significant.	Newborns born to mothers with epidural analgesia had higher tendency to pass urine later than the newborns without epidural analgesia. The P value among the two groups in breastfeeding initiation was not significant (P=0.60). Birth asphyxia was 3 in case and 1 in control group although P value was not statistically significant (P =0.621). Instrumental delivery was significantly higher in case group 11 compare to 2 in control group with P value 0.010. **Conclusion:** The epidural group had delayed urine passage and more instrumental delivery. There was no effect on breastfeeding or birth asphyxia.	**Strengths:** The study either received epidural (same medication for everyone) or no epidural. **Limitations:** Single facility

Author Recommendations:
The effect of epidural analgesia on the neonate is of immense significance and should be further explored in the future with randomized controlled multi-center studies

Summary for current clinical practice question:

Epidural group had delayed urine passage, more instrumental delivery

Source:
Garcia-Lausin, L., Perez-Botella, M., Duran, X., Rodríguez-Pradera, S., Gutierrez-Martí, M. J., & Escuriet, R. (2019). Relation between Epidural Analgesia and severe perineal laceration in childbearing women in Catalonia. *Midwifery, 70*, 76–83. doi:10.1016/j.midw.2018.12.007

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To study the association between epidural analgesia and risk of severe perineal laceration (SPL). **Sample:** 5497with singleton, cephalic, 37-41wks gestation with vaginal delivery, age 18-40yrs. **Setting:** 30 hospitals in Catalonia, Spain **Level of evidence: III** **Quality of evidence: High**	Prospective study. Main outcome: Severe perineal laceration involving the anal sphincter (third and fourth degree). main exposure variable was use of epidural analgesia (EA) during vaginal birth (EA vs. non-EA). Mode of vaginal birth (non-instrumental versus instrumental birth) was analyzed at it relates to SPL. Confounders such as augmentation, episiotomy, parity, lithotomy position, birth weight and gestational age were included in the analysis.	77.5% of sample used EA during labor. 73.5% of women with oxytocin augmentation used EA. No EA group,1.3% suffered SPL, and 1.7% who used EA suffered SPL, (p= 0.324). Women with EA, 28.4% had instrumental birth. 74.92% of EA users adopted the lithotomy compare to 34.87% none EA users. 0.9% with SVD and EA had SPL and 1.1% with SVD who did not use EA had SPL, (p: 0.531). Instrumental birth with EA and no EA was not statistically significant P= 0.364. **Conclusion:** EA was not associated with an increased risk of SPL. Instrumental birth and primiparity were the strongest associated risk factors for SPL.	**Strengths:** Large sample led by midwives. **Limitations:** Low incidence of SPL prevents drawing any firm conclusions.

Author Recommendations:
A philosophy change of maternity care provision among Obstetricians and Midwives from one that is medically focused to one that is woman-centered to promote physiological birth.

Summary for current clinical practice question:
EA does not increase risk for severe vaginal tears.

Source:
Srebnik, N., Barkan, O., Rottenstreich, M., Ioscovich, A., Farkash, R., Rotshenker-Olshinka, K., … Grisaru-Granovsky, S. (2019). The impact of epidural analgesia on the mode of delivery in nulliparous women that attain the second stage of labor. The Journal of Maternal-Fetal & Neonatal Medicine, 1–8. doi:10.1080/14767058.2018.1554045

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To evaluate the impact of epidural analgesia on the mode of delivery of nulliparous women. **Sample:** 25,643 nulliparous women with a single live fetus in vertex presentation at 37–42 weeks at second stage of labor. **Setting:** Jerusalem, Israel. **Level of evidence: III** **Quality of evidence: High**	Retrospective cohort study. During August 2005 and December 2014 period. Primary outcome: Mode of delivery. Secondary outcome: prolonged 2nd stage and maternal and neonatal adverse outcomes (shoulder dystocia, bleeding, 3rd-4th tears, fever, Apgar, NICU admission).	Second stage longer for epidural users 94min vs 33min for non-users. OP presentation 3.9% vs 2.6% non-users. Instrumental deliveries 19.8 vs. 6.8%. PPH 14.1 vs 9.7% p< .001 and shoulder dystocia, 0.2 vs 0.1% p= .006. Epidural user had higher rate of low 5min Apgar. **Conclusion:** Epidural analgesia was an independent risk factor for instrumental delivery. It resulted in a Prolonged second stage with higher rates of instrumental delivery and PPH.	**Strengths:** Single epidural med formula and administration. Excellent analysis of data. Control of confounding variables in data analysis. **Limitations:** Single center with population of similar characteristics, applicability to other groups.

Author Recommendations:
Prolonged second stage puts women at higher risk for operative/instrumental delivery, regardless of epidural use.

Summary for current clinical practice question:
Epidural users, 70% nulliparous, low bishop score on admission, are more likely to get Pitocin augmentation.

Epidural increased length of second stage and increased instrumental delivery. No lasting effect on neonate.

Source:
Orbach-Zinger, S., Landau, R., Davis, A., Oved, O., Caspi, L., Fireman, S., … Eidelman, L. A. (2018). The effect of labor epidural analgesia on breastfeeding outcomes: A prospective observational cohort study in a mixed-parity cohort. *Anesthesia & Analgesia.* doi:10.1213/ane.0000000000003442

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To examine the influence of labor epidural on breastfeeding outcomes at 6 weeks postpartum in a mixed-parity cohort. **Sample:** 1204 women with gestational age >37 weeks at delivery, eligible for epidural, intending to breastfeed and no NICU admission. **Setting:** Beilinson Hospital, Israel. **Level of evidence: III** **Quality of evidence: High**	Prospective observational cohort study. Primary outcome: Breastfeeding rates at 6 weeks postpartum. Assessment done within the first 18 hours of delivery with an in-person interview, 2 phone call interviews at 3 day postpartum and 6wk postpartum. A multivariable regression analysis used to evaluate the relationship between epidural use and the primary outcome.	Epidural use identified as the only variable associated with reduced breastfeeding at 6 weeks (odds ratio [OR], 0.60; 95% CI, 0.40–0.90; P = .015). Multiparous women were less likely to deliver with epidural than nulliparous women (61.8% vs 84.9%; P < .001), were more likely to breastfeed at 6 weeks (80% vs 70%; P < .001), and more likely to exclusively breastfeed at 6 weeks (61% vs 41.7%; P < .001). **Conclusion:** Breastfeeding rates at 3 days and at 6 weeks were significantly lower among women delivering with epidural analgesia. Multiparous women with previous breastfeeding experience had better success rates.	**Strengths:** Excellent study design and analysis. Large sample. Large percentage of women breastfeeding and had epidural. **Limitations:** No mentioning of breastfeeding exclusivity or supplementation.

Author Recommendations:
Further studies are needed on psychophysical factors predisposing women to request epidurals that affect breastfeeding outcomes.

Summary for current clinical practice question:
Epidural anesthesia affects breastfeeding duration. Total fentanyl used had an effect. Factors contributing to this include psychosocial (pain tolerance) and experience with breastfeeding.

Source:
Shmueli, A., Salman, L., Orbach-Zinger, S., Aviram, A., Hiersch, L., Chen, R., & Gabbay-Benziv, R. (2018). The impact of epidural analgesia on the duration of the second stage of labor. *Birth, 45*(4), 377–384. doi:10.1111/birt.12355

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: Describe the length of second stage of labor in relation to parity and epidural analgesia use. **Sample:** 15500 laboring women with singleton, cephalic, term (37-42 weeks) non-operative vaginal deliveries with no known fetal anomalies. **Setting:** Rabin Medical Center, Petach Tikva, Israel. **Level of evidence: III** **Quality of evidence: High**	Retrospective cohort. Retrieved data computerized perinatal database between January1, 2012 and December 31, 2014. Prolonged second stage was defined according to the Friedman's curve after 3 hours of full dilation among nulliparas with regional analgesia and 2 hours among nulliparas without regional analgesia and for multiparous women 2 hours with epidural and 1hour without. Linear regression analysis to evaluate significant confounders that contribute to the second-stage length.	Epidural analgesia was associated with an additional 82 minutes for the 95th percentile for both nulliparas and multiparas. **Conclusion:** There was a longer second stage and a higher rate of operative vaginal deliveries with epidural use.	**Strengths:** Large sample, controlled confounding factors. **Limitations:** Excluded patients that had c/s due to prolonged second stage.

Author Recommendations:
The second stage of labor management should be reconsidered in light of contemporary data regarding labor curve change and the effect of labor intervention such as epidural use and oxytocin administration.

Summary for current clinical practice question:

Prolonged second stage with epidural use necessitating operative delivery.

Source:
Bannister-Tyrrell, M., Ford, J. B., Morris, J. M., & Roberts, C. L. (2014). Epidural analgesia in labour and risk of caesarean delivery. *Paediatric & Perinatal Epidemiology, 28*(5), 400–411. https://doi-org.ezproxy.bethel.edu/10.1111/ppe.12139

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To determine if epidural analgesia for labor compared with no epidural analgesia is associated with an increased risk of cesarean delivery. **Sample:** Cohort of pregnant women (n = 210 708) without major obstetrical complications who delivered a singleton live infant in hospitals where epidural analgesia is readily available. **Setting:** New South Wales, Australia, **Level of evidence: III** **Quality of evidence: High**	Non-Experimental descriptive cohort design study. Data was collected from national birth data collections and diagnosis coding systems. Primary variables evaluated was epidural and incidence of cesarean delivery for failure to progress and/or fetal distress in nulliparous women using propensity score matching model.	N = 210 708, cesarean delivery occurred 20 531 (9.8%). Epidural analgesia was used by 66 317 (31.5%) women, of whom 14 231 (21.6%) had a caesarean delivery. In the matched pairs, the frequency of cesarean delivery was 19.5% in group epidural and 7.7% in the no group epidural, a risk ratio for caesarean delivery was 2.5 [95% CI 2.5, 2.6] for women receiving epidural. **Conclusion:** In this study, epidural analgesia increased the relative risk of cesarean delivery by 2.5 and the absolute risk by 11.9%. The study found a strong association between epidural analgesia in labor and caesarean delivery for failure to progress.	**Strengths:** Large sample, representative of the nation of study and parity. **Limitations:** Research design to control confounding factors. No data on the timing of administration of epidural analgesia in labor relative to the timing of diagnosis of labor dystocia, which may then lead to caesarean delivery for failure to progress.

Author Recommendations:
Further research should investigate the extent to which variation in clinical practice explains this association between epidural analgesia in labor and cesarean delivery, and whether different labor management strategies limit the risk of caesarean delivery for women who choose to use epidural analgesia as their preferred method of labor pain relief.

Summary for current clinical practice question:
Epidural analgesia effect mode of delivery increasing risk for C-section.

Source: Lavesson, T., Källén, K., & Olofsson, P. (2017). Fetal and maternal temperatures during labor and delivery: A prospective descriptive study. *The Journal of Maternal-Fetal & Neonatal Medicine, 31*(12), 1533–1541. doi:10.1080/14767058.2017.1319928			
Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: Study fetal scalp temperature (FST) and maternal axillary temperature (MAT) during labor relative to progression of labor, uterine contractions (UC) and epidural analgesia (EDA). **Sample:** 132 women without fever or taking antipyretics. Inclusion criteria were cephalic presentation, >36wks, without risk factors. **Setting:** Helsingborg Hospital, Sweden **Level of evidence: III** **Quality of evidence: Good**	Prospective descriptive study. Temperatures were recorded continuously in labor with a bi-metal temperature sensor attached to the axilla (MAT) and a similar sensor mounted in a scalp electrode (FST). The temperature data were stored electronically and analyzed offline at cervical dilatations of 2–3, 5, 7–8, and 10 cm, and at full dilation. The FST was read before, at increasing, at peak, at decreasing, and after UC. The MAT and FST curves were compared with mixed-effect models statistics for repeated measurements.	This study showed small but significant increases in fetal and maternal temperatures with progression of labor. The FST before, during, and after UCs found no significant changes. At full dilatation and retraction, the mean FST was approximately 0.5 C higher and the mean MAT 0.7–0.8 C higher in women with EDA. **Conclusion:** Epidural had a significant influence on both the fetal and maternal temperatures. With epidural analgesia, the FST and MAT upward pointing slopes were steeper than when without EDA, and the resulting temperatures were higher.	**Strengths:** Good methodology. **Limitations:** Small sample.
Author Recommendations: More research recommended on normal temperature references ranges related to stage of labor.			
Summary for current clinical practice question: Epidural analgesia increases maternal temperature during labor.			

Source:
Zhou, D., Gong, H., He, S., Gao, W., & Wang, Q. (2017). Effects of combined spinal epidural labor analgesia on episiotomy: A retrospective cohort study. *BMC Anesthesiology, 17*, 1-6. doi:10.1186/s12871-017-0381-8

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To assess the association between combined spinal–epidural analgesia (CSEA) and the incidence of episiotomy during vaginal delivery. **Sample:** N= 11,994 nulliparous women with spontaneous vaginal delivery, singleton and cephalic presentation, gestational age 37-42 weeks. **Setting:** Northwest Women's and Children's Hospital, Xi'an, China. **Level of evidence: III** **Quality of evidence: Good**	Retrospective cohort study. cohort of 5748 women in the CSEA group and 6246 women in the non-CSEA group. Primary outcomes measured was incidence of episiotomy. Secondary was duration of second stage, blood loss, instrumental delivery, Apgar scores and NICU admission. CSEA used was spinal anesthesia with 2–3 mg of 0.1% ropivacaine with 0.5 μg/mL sulfentanyl. A propensity scoring 1:1 matching algorithm was used to match CSEA and non-CSEA.	1838 (44.7%) cases in the Non-CSEA group and 1953 (47.4%) cases in the CSEA group received episiotomy. Apgar score < 7 at 5 min was 0.4% in the Non-CSEA group and 0.2% in the CSEA group. The rate of NICU admission was 0.3% in the Non-CSEA group and 0.4% in the CSEA group. **Conclusion:** The incidence of episiotomy was higher in the CSEA group but when adjusted for maternal age, gestational age, infant birth weight and prolonged second stage of labor, it was found that CSEA did not increase the risk of episiotomy (adjusted OR 1.080, 95% CI 0.988–1.180). No difference was observed in duration of second stage, blood loss, or instrumental delivery.	**Strengths:** Large sample. **Limitations:** Results did not always match the conclusion.

Author Recommendations:
There is still insufficient evidence regarding whether or not CSEA prolongs labor and adequately powered randomized control trials are needed to clarify.

Summary for current clinical practice question:
CSEA is not an independent factor for getting an episiotomy. No difference observed in duration of second stage, blood loss, instrumental delivery.

Source:
Adams, J., Frawley, J., Steel, A., Broom, A., & Sibbritt, D. (2015). Use of pharmacological and non-pharmacological labour pain management techniques and their relationship to maternal and infant birth outcomes: Examination of a nationally representative sample of 1835 pregnant women. *Midwifery*, *31*(4), 458-463. doi:10.1016/j.midw.2014.12.012

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To examine if pharmacological or non-pharmacological interventions for pain control during labor effect birth outcomes. **Sample:** 1835 women mixed parity. **Setting:** Sub-sample of Australian Longitudinal Study on Women's Health **Level of evidence: III** **Quality of evidence: Good**	Non-experimental descriptive study. Logistic regression models were used to determine the association between pain management techniques and birth outcomes. Birth outcomes of vaginal tears, instrumental delivery, admission of the baby to a special care nursery, breast-feeding initiation, and duration were evaluated as it relates to pharmacological methods (gas, meperidine and epidural) and non-pharmacological (i.e. breathing techniques, massage, hypnotherapy, TENS machine, bath/birthing pool/shower, acupressure/acupuncture) techniques.	Women who required an epidural were more likely to have instrumental delivery ($p<0.001$) and have their baby admitted to a special care nursery ($p<0.001$), compared to women who did not require an epidural. The women who used epidural were also less likely to have a vaginal tear ($p<0.001$) and less likely to continue breast-feeding beyond six weeks ($p=0.006$). **Conclusion:** Epidural use increases the likelihood of experiencing an instrumental childbirth and admittance of the newborn to a special care nursery.	**Strengths:** Large sample. Recent study. **Limitations:** Multiple confounding factors that needed to be analyzed.

Author Recommendations:
Adjusting for place of birth, concomitant health conditions, medical history, and provider type, the association between epidural and the increased likelihood of experiencing these negative birth outcomes remains evident and this suggests that the intervention itself (rather than other factors) may possibly contribute to these risks.

Summary for current clinical practice question:
Epidural increases risk for instrumental delivery. It also increases special care nursery admission and decreases duration of breastfeeding >6wks.

Source:
Herrera-Gómez, A., García-Martínez, O., Ramos-Torrecillas, J., De Luna-Bertos, E., Ruiz, C., & Ocaña-Peinado, F. M. (2015). Retrospective study of the association between epidural analgesia during labour and complications for the newborn. *Midwifery, 31*(6), 613–616. doi:10.1016/j.midw.2015.02.013

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To determine association between epidural analgesia during labor and neonatal outcome. **Sample:** N=2399 newborns >37wks gestation with no maternal or fetal health complications. 1848 born to mothers who didn't receive epidural, 551 received epidural in **Setting:** San Juan de la Cruz Hospital of Ubeda in Jaen, Spain **Level of evidence: III** **Quality of evidence: Good**	Retrospective study. Data retrieved from electronic medical records. Researchers divided the mothers into two groups, case and control. They measured Apgar scores, neonatal intensive care unit (NICU) admission, need for resuscitation, and timing of breastfeeding onset. Apgar scores assessed at 1 min and 5min NICU admission. Resuscitation needed by infants was also recorded and classified as basic or advanced. Breastfeeding onset was considered early if infant nursed within the first two hours after birth.	Lower mean Apgar score at one and five minutes with epidural group ($p<0.0001$). NICU admission was 8.2% with epidural groups versus 4.6% of non-epidural group, $p=0.003$. Resuscitation was required by 28.7% in epidural group vs. 17.6% in the other group. Early breastfeeding initiated by 82.4% of epidural group and 91.1% of non-epidural group. **Conclusion:** Epidural analgesia was associated with slightly increased risk for lower Apgar scores, greater need for NICU admission and or resuscitation and delayed onset of breastfeeding.	**Strengths:** Large sample, good methodology and analysis. **Limitations:** Low epidural recipient rate.

Author Recommendations:
More studies into the effects of epidural on the neonate.

Summary for current clinical practice question:

Epidural analgesia affects neonatal well been at birth with lower Apgar scores, need for resuscitation, and delayed breastfeeding.

Source:
Hung, T. H., Hsieh, T. T., & Liu, H. P. (2015). Differential effects of epidural analgesia on modes of delivery and perinatal outcomes between nulliparous and multiparous women: A retrospective cohort study. *PLOS ONE, 10*(3). doi:10.1371/journal.pone.0120907

Purpose/Sample	Design (Method/Instruments)	Results	Strengths/Limitations
Purpose: Study maternal demographic and pregnancy characteristics associated with epidural analgesia and to investigate the effects of epidural analgesia on the modes of delivery and perinatal outcomes in nulliparous and multiparous women. **Sample:** N=16,852 of deliveries after 37 weeks of gestation, healthy singleton in vertex. **Setting:** Chang Gung Memorial Hospital, Taipei, Taiwan. **Level of evidence:** III **Quality of evidence: Good**	Retrospective cohort study between January 1, 2001, and December 31, 2013. Data from a computerized obstetrics database. Primary outcome evaluated: Mode of delivery. Secondary outcomes: Neonatal death (within 28 days of birth), NICU admission, Apgar scores <7, placental abruption, acute chorioamnionitis, severe perineal injury (third and fourth degree perineal injuries), and postpartum hemorrhage (>500 ml for vaginal delivery and >1000 ml for caesarean delivery). Statistical analyses were performed using SPSS software	Maternal characteristics associated with epidural use are: >34 years of age, a prepregnancy BMI < than 19.8 kg/m2 or greater than 24.2 kg/m2, GBS positive, diabetes mellitus. Epidural was associated with an increased rate of operative vaginal delivery and a longer labor duration in the first and second stages of labor in both the nulliparous and multiparous. Epidural was associated with a lower rate of c/s in the nulliparous women, while no difference observed in multiparous women. Increased rate of Apgar scores <7 at 1-minute was noted in the nulliparous women. **Conclusion:** Epidural increased operative vaginal delivery but not c/s rate.	**Strengths:** Large sample evaluated multiple factors. 71% of women received epidural. **Limitations:** Single hospital, specific to Chinese women.

Author Recommendations:
Randomized control trials for further study of outcomes evaluated on this study.

Summary for current clinical practice question:
Epidural increased operative vaginal delivery but not c/s rate.

Source:
Rukewe, A., Adebayo, O., & Fatiregun, A. (2015). Combined spinal-epidural analgesia for laboring parturients in a Nigerian hospital. *Annals of African Medicine, 14*(3), 143-147. doi: 10.4103/1596-3519.149920

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To describe combined spinal-epidural (CSE) experience in nulliparous and parous parturients in labor. **Sample:** Thirty total, 21 nulliparous, 9 parous at term, singleton pregnancy in labor. **Setting:** Hospital setting, Nigeria **Level of evidence: III** **Quality of evidence: Good**	Retrospective, observational study. CSE given per maternal request. Outcomes measured included maternal vital signs, pain scores, FHR, uterine contractions, cervical dilation, delivery method and neonatal Apgar scores.	The quality of analgesia experienced was similar in both groups (nulli vs multip) but nulliparous women had cesarean delivery (23.3%) while the parous women had no CD. Reason for CD was cervical dystocia/poor progress of labor despite having oxytocin augmentation. Nulliparous mothers had lower 1-min Apgar score than parous women but not difference in 5-min Apgar. **Conclusion:** CSE can be safely used in every laboring parturient irrespective of parity either in early or late labor stage.	**Strengths:** New information in subject not well studied. **Limitations:** Small sample

Author Recommendations:
Combined spinal-epidural is safe and effective pain management option for labor women

Summary for current clinical practice question:
CSE increase risk for CD for nulliparous women.

Source:
Wassen, M. M. L., Hukkelhoven, C. W. P., Scheepers, H. C. ., Smits, L. J. M., Nijhuis, J. G., & Roumen, F. J. M. E. (2014). Epidural analgesia and operative delivery: A ten-year population-based cohort study in the Netherlands. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, *183*, 125–131. doi:10.1016/j.ejogrb.2014.10.023

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To evaluate the association of epidural analgesia and operative delivery. **Sample/Setting:** 1,378,458 women with singletons in cephalic position between 37-42 weeks' gestation in Netherland between Jan/2000-Jan/2010 **Level of evidence: III** **Quality of evidence:** Good	Retrospective cohort study. Data was obtained from the Perinatal Registry of The Netherlands (PRN). Primary outcome evaluated operative delivery either c/s or instrumental vaginal delivery. Trends of epidural use and operative delivery over time was also analyzed. Logistic regression analyses were used to study the association between epidural and operative delivery.	Nulliparous: Epidural use increased from 7.7% to 21.9% for nulliparous women while CS rate did not increase much (from 9.0% to 11.8%; $p < 0.001$), and the proportion of IVDs decreased by 3.3% (from 22.7% to 19.4%; $p < 0.001$). Multiparous: Epidural use increased from 2.4% to 6.8%, while the percentage of CS slightly increased (from 3.8% to 4.6%; $p < 0.0001$), and the rate of IVDs decreased by 0.7% (4.1% to 3.4%; $p < 0.001$). **Conclusion:** There is a slight increase in unplanned c/s rates and a decrease in instrumental vaginal delivery. The association between epidural and operative deliveries grew weaker with advancing years.	**Strengths:** Large sample over a decade of study **Limitations:** External validity- limited to Dutch women, epidural medications and methods have changed over time.

Author Recommendations:
Further research into contemporary epidural formulation and techniques.

Summary for current clinical practice question:
Epidural use slightly increases unplanned c/s rates but not instrumental delivery.

Source:
Hasegawa, J., Farina, A., Turchi, G., Hasegawa, Y., Zanello, M., & Baroncini, S. (2013). Effects of epidural analgesia on labor length, instrumental delivery, and neonatal short-term outcome. *Journal of Anesthesia, 27*(1), 43–47. doi: 10.1007/s00540-012-1480-9

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To clarify whether the short-term adverse neonatal outcomes associated with epidural analgesia are due to the epidural analgesia itself or to the instrumental delivery. **Sample:** 350 (case group) received epidural and 1400 (control group) no epidurals. Inclusion criteria complete prenatal care, singleton and vertex presentation who were attempting vaginal delivery. **Setting:** Hospital setting in Bologna, Italy **Level of evidence: III** **Quality of evidence: Good**	Non-experimental study with retrospective, case-controlled design. Primary outcome: Mode of delivery. Secondary outcome; Arterial pH and Apgar score. General Linear Model statistical analysis model was used to evaluate the effects of both analgesia and the mode of delivery on the baby. Labor duration was measured from onset of labor to delivery using Kaplan-Meier method. The patients that had similar demographics (BMI, maternal age, estimated fetal weight by ultrasound) were selected in a 1:4 case-control ratio. Patients received epidural at 3-4cm dilation. For instrumental delivery, only Kiwi and Mityvac vacuum deliveries were included in the study.	The mean lengths of the 1st stage and 2nd stage of labor was 176 and 31 min in controls versus 269 and 39 min in cases. Differences remained even after adjustment for parity. Vacuum extraction and cesarean section were more frequently performed in cases than controls ($p < 0.001$). The Apgar scores and umbilical arterial pH were significantly lower in the neonates delivered by vacuum extraction compared with those in infants with spontaneous delivery or infants delivered by cesarean section. The mode of delivery much more consistently affected pH compared with to analgesia (the β coefficients were −0.036 vs. −0.050) **Conclusion:** Instrumental delivery more strongly affects the outcomes than the epidural analgesia itself.	**Strengths:** Address the topic of epidural effect on neonate well. **Limitations:** Low rate of epidural users and very regimented.

Author Recommendations:
Epidural analgesia induced slowly progressing labor, resulting in an increased rate of instrumental delivery. Instrumental delivery due to dystocia and/or fetal distress may adversely affect neonatal outcomes

Summary for current clinical practice question:
Epidural effects observed in this study were longer labors and instrumental delivery lowers pH and Apgar scores.

Source:
Lucovnik, M., Blajic, I., Verdenik, I., Mirkovic, T., & Stopar Pintaric, T. (2018). Impact of epidural analgesia on cesarean and operative vaginal delivery rates classified by the Ten Groups Classification System. *International Journal of Obstetric Anesthesia, 34*, 37–41. doi:10.1016/j.ijoa.2018.01.003

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: Evaluate associations between epidural and cesarean and assisted vaginal delivery. **Sample:** 207,525 laboring women (induced or spontaneous) included in the study in all of the perinatal Ten Group Classification System (TGCS). **Setting:** Slovenia **Level of evidence: III** **Quality of evidence: low quality**	Retrospective study. Data from Slovenian National Perinatal Information System (NPIS) From 2007-2014. The SPSS Statistics software was used to analysis TGCS groups to assess labor and delivery outcomes of cesarean delivery and assisted vaginal delivery. P significance level was set at <0.003.	Higher c/s rate for women with epidural in group 1 (nulliparous term, singleton fetus in cephalic presentation with spontaneous labor) and group 9 (abnormal fetal lies). The rate of assisted vaginal delivery was higher in women with epidural in groups 1–5. **Conclusion:** An association exists between epidural use and higher c/s and instrumental delivery, especially in nulliparous women.	**Strengths:** Large sample over longer study period. **Limitations:** Potential multiple confounding factors not controlled for in this study and the retrospective nature of data. Causality can't be determined, only association.

Author Recommendations:
Request for epidural may be a marker of dysfunctional (prolonged or obstructed) labor, since women with complicated labors are more likely to require more efficient analgesia. Future studies on the characteristics of nulliparous women requesting epidural should be performed further since preventing cesarean delivery in this group of women is a very important goal.

Summary for current clinical practice question:
Increased rates of operative delivery for women receiving epidural anesthesia particularly for nulliparous women.