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The Effect of Amniotomy on Labor Progression

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Lauren Marie Casey

Abstract

Background/Purpose: Amniotomy has been a tool used for over 50 years to progress labor. This literature review researches the effects that amniotomy has on active labor progression.

Theoretical Framework: The theoretical framework selected for this literature review was The System's Model by Betty Neuman. This theory focuses on the effects that internal and external forces have on health. This was selected because of the effects that amniotomy can have on labor progression.

Methods: For this review, the 20 articles were selected following a search in The Cumulative Index to Nursing and Allied Health Literature (CINAHL), CINAHL Plus, Cochrane Database of Systematic Reviews, The American Journal of Obstetrics & Gynecology, Scopus, GOOGLE Scholar, PubMed, and ScienceDirect. These were further evaluated using John Hopkins Nursing Evidence Based Practice Model guidelines and determined to be of high quality.

Results/Findings: Throughout this review, it was concluded that amniotomy can be a safe and effective tool in reducing the overall time of labor when used after the cervix is dilated 3cm and the woman is in active labor. Special consideration should be afforded to nulliparous patients, as they can progress much slower. Fifteen selected articles focused on the efficacy of labor progression and how amniotomy effects the pattern of labor. It was found that amniotomy does not raise the risk for cesarean section, shoulder dystocia, or maternal infection when done within the correct parameters.

Implications for Research and Practice: The implications for this study encompass the rationale for performing amniotomy and whether or not it is a safe and effective labor intervention. Amniotomy can be a safe and effective tool to progress labor once an active labor

pattern is established and the patient is 3-4cm dilated. With limited research on the risks of amniotomy, it should be used judiciously until further studies can conclude its safety.

Keywords: amniotomy, artificial rupture of membranes, induction of labor, augmentation, augmentation of labor, Bishop score, cesarean section, nulliparous, multiparous, active labor, labor progression

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Chapter One: Introduction

Amniotomy, also known as artificial rupture of membranes (AROM), is a common obstetrical procedure performed by midwives and obstetric physicians for a variety of reasons during the induction or augmentation of labor. Many scholarly articles and clinical trials discuss the benefits that amniotomy can have on labor, but many of these researchers are also concerned about the potential risks that can accompany this procedure (Onah, Dim, Nwagha, & Ozumba, 2015). Often considered the first line intervention to encourage and progress slow or stalled labor, early amniotomy decreases the overall time of labor, lowers the rate of primary cesarean sections, and even minimizes the incidence of umbilical cord prolapse (Dilbaz et al., 2006). However, the benefits and risks to this intervention may vary depending on the stage of labor and gravida. There are many risks associated with AROM, including the potential for prolonged rupture of membranes when performed prematurely (Makarem, Zahran, Abdellah, & Karen, 2013). With wide controversy and speculation surrounding the safety of this intervention, it is critical to investigate this practice further for the health of the mother and child both before and after delivery. Throughout this literary review of current research, the practice of amniotomy will be critically evaluated to determine not only the efficacy of the intervention but also the safety concerns it can have on both mother and baby.

Statement of Purpose

The purpose of this literature review is to analyze current research to determine the effect artificial rupture of membranes has on labor progress and the safety associated with this common procedure, while critically examining recommendations and evidence-based practice methods concerning the overall safety for mother and child. By examining both risks and benefits, the authors intend to determine if the intervention benefits outweigh the associated risks; this

determination can in turn aid in creating more specific practice guidelines and protocols for the labor setting and can influence the creation of position statements by key professional organizations, such as the American College of Obstetricians and Gynecologists (ACOG) and the American College of Nurse-Midwives (ACNM). The primary question being explored in this critical literature review is: "What is the effect of artificially rupturing membranes on the progression of labor"?

Evidence Demonstrating Need

Providing every woman with a safe and individualized plan of care based on her needs throughout labor should be the primary focus when deciding on labor interventions. With the rate of elective induction and/or augmentation reaching over 50% in the United States, it is necessary to determine whether interventions performed throughout the labor process are causing further harm (Cunningham et al., 2014).

The induction of labor is the use of pharmacologic or mechanical means to stimulate uterine contractions prior to natural spontaneous labor, and amniotomy is one method that can be utilized in this context (Association of Women's Health, Obstetric and Neonatal Nurses, 2014). According to national birth certificate data, 23% of all births in the United States are medically induced (National Partnership, 2016). The risks involved with these inductions include postpartum hemorrhage, fetal distress, and significantly increased cesarean sections (AWHONN, 2014). Early versus late amniotomy will also be examined throughout this research, as it is a factor that is often questioned when weighing the risks and benefits of the procedure.

Augmentation of labor occurs when interventions are performed to either hasten or progress labor that occur spontaneously. Early amniotomy is the most commonly used method of augmenting labor with the goal of a faster progressing labor or preventing labor dystocia (Onah

et al., 2015). With the ever-increasing rate in which inductions are performed prior to spontaneous labor, fewer labors are only augmented. For this reason, this literature review will explore amniotomy as both an induction and augmentation method. In order to distinguish the effectiveness of amniotomy for both induction and augmentation, there must be an understanding of the statistical difference of the overall labor lengths between nulliparous and multiparous women.

The timing and decision to artificially rupture membranes is disparate depending on the provider or geographical region. Complications can potentially arise when providers rupture membranes prior to adequate fetal engagement, potentially leading to cord prolapse or compression, maternal or fetal infection, heart rate deceleration, or bleeding (Bostanci, Eser, Abide, Kilicci, & Kucukbas, 2018). The hope for this literature review is to provide evidence and research-based data to equip providers and their patients with the most relevant tools necessary to determine whether amniotomy is indicated and if the benefits outweigh the risks.

It is the medical professional's duty to prevent undue harm to patients in all cases. According to The Centers for Disease Control (2017), cesarean section rates are at an all-time high in the United States, rising dramatically to 32% of all deliveries in 2018. It is important to examine the potential causes for why cesarean sections have so drastically increased and what can be done to reverse this trend. Since a cesarean section is a major abdominal surgery with a much harder and longer recovery time than a vaginal delivery, it is necessary to determine causes in order to begin decreasing this rate. While the purpose of this review is not necessarily to examine the cesarean section rate, the included studies will be analyzed to determine how the intervention of artificial rupture of membranes impacts the overall rate of cesareans. With multiple organizations and professional bodies working to reduce primary cesareans, using root

cause analysis will aid in determining the effect artificial rupture of membranes has on the cesarean rate.

Significance to Nurse-Midwifery

According to the American College of Nurse-Midwives (ACNM), "Midwives are primary care providers and leaders of maternity care homes" (2012). As leaders of maternity care, it behooves all midwives to be aware of the risks and benefits to every performed procedure. No clear position statement exists from either the ACNM or the American College of Obstetrics and Gynecology (ACOG) on the use of amniotomy. Clear guidance is necessary on the safety, effectiveness, risks, benefits, and timing for performing an artificial rupture of the membranes. Understanding the effect that amniotomy has on labor progress is key in determining if the benefits outweigh the risks. Therefore, it is necessary to analyze and disseminate past and present research in order to establish a more specific evidence-based practice for performing this procedure.

It is a midwife's duty to provide safe care, do no harm, and strive for a happy and healthy birthing process. The *Hallmarks of Midwifery* highlight that midwives value advocating for non-intervention in the absence of complications (ACNM, 2012). One study, exploring artificial rupture of membranes, found that almost 24 % of the cases of amniotomy had no clear indication for the procedure (Saadia, 2014). A key component of midwifery care in the management process is to identify problems and diagnoses that warrant interventions (ACNM, 2012). This should be done prior to making the decision to perform an intervention. The ACNM's position statement on induction of labor also verified that "spontaneous labor offers substantial benefit to the mother and the newborn" and that "disruption of this process without an evidence-based medical indication" increases the risk for potential harm (ACNM, 2016).

Potentially, through this research, the timing in performing the medical procedure of an amniotomy and its benefits can be optimized. There is clear evidence showing the benefits amniotomy can have during an induction or augmentation (Macones, Cahill, Stamilio, & Odibo, 2012). However, similar to the use of vacuum or forceps, there needs to be a clear indication that this procedure is necessary which should outweigh any risks associated with the procedure. Allowing the client to thoroughly understand the risks and benefits associated with the intervention will allow midwives to deliver a higher level of autonomy by providing informed consent.

Theoretical Framework

Because this literary review is intended to educate and guide obstetric providers and nurse-midwives towards safe and effective labor interventions, it is important to use theoretical models of change to describe the current problem and the driving forces behind them. *The Systems Model* (Neuman, 2011) provides a system-based nursing approach, while focusing on the need for flexibility. The focus with this theory is that patients and their bodies react to actual or potential environmental stressors.

In this theory, it is acknowledged that the use of nursing prevention intervention can be effective in retaining and maintaining a patient's state of wellness (Neuman, 2011). Viewing the environment as all forces that surround a patient, Newman has identified three environments: internal, external, and created. Internal environment refers to intrapersonal influences, which includes a woman's hormone levels and how she copes with pain (Ahmadi & Sadeghi, 2017). An example of an external influence could be her environment, such as the lighting of a room, the people she is around, and the sound of music in her room. Created influences are often seen as developed unconsciously by the patient to support coping (Ahmadi & Sadeghi, 2017).

One of the major assumptions of this model is that "each client system is unique, a composite of factors and characteristics within a given range of responses" (Alligood & Mirriner-Tomey, 2014, p. 285). Thus, each patient's reaction to a given external stressor may produce a large range of responses. This explains the need for a large study size in order to conclude effectiveness of a specific procedure or treatment.

Neuman also focused on three levels of nursing intervention, namely primary, secondary, and tertiary prevention (as cited in Ahmadi & Sadeghi, 2017). Primary refers to prior to the stressor, secondary is after the stressor has created a response, and tertiary is after the treatment. In relating this to an amniotomy, it is important to note how a patient is coping with labor and how labor is progressing prior to adding an external stressor, such as an amniotomy. An evaluation must then be performed to determine if the patient is coping well through the labor process. Tertiary intervention explains the need to evaluate and treat the patient for optimal stability after treatment (Ahmadi & Sadeghi, 2017).

Summary

In studying the effect artificial rupture of membranes has on a woman's labor progress, the reaction to an external environmental stressor is examined. As a key component of the Systems Model, prevention intervention is a reminder that the promotion of a safe and healthy environment is key to the patient's success. The goal of primary prevention is to reduce the possibility of encountering a stressor. In this case, preventing the added stressor of artificial rupture of membranes, or knowing the optimal times to use it as a resource, may be a key component to a healthy progression of labor and a healthy delivery.

Chapter II: Methods

The primary purpose of this chapter is to discuss the methodology used to further understand scholarly literature related to the effects that amniotomy has on labor progression and its safety for mother and baby. Search strategies were utilized with inclusion and exclusion criteria in selecting the most appropriate articles for this review. Throughout the period in which research was gathered, 49 research articles were reviewed and validated for their pertinence to the topic. Using strict inclusion and exclusion criteria, 20 articles were found to reflect the needs of this review and were therefore selected.

Search Strategies

It was important to review literature that was not only academically relevant but also contemporary. While labor and childbirth have existed since the beginning of mankind, the modern methods to induce and augment labor have changed and practices studied 20 years ago might not be performed today. It is for this reason that the majority of the research used for this review was published in the last five years. The research chosen for this literary review spans 1993-2018 with only three aged greater than the five years. One article, published in 1993, was included as it is considered a gold standard for this topic and is cross referenced in most of the subsequent studies. The other two studies older than five years were written in years 2013 and 2014. These were included based on the high study group size, as well as being high quality studies that were pertinent to this review.

The following scholarly databases were used to search for these articles: The Cumulative Index to Nursing and Allied Health Literature (CINAHL), CINAHL Plus, Cochrane Database of Systematic Reviews, The American Journal of Obstetrics & Gynecology, Scopus, GOOGLE Scholar, PubMed, and ScienceDirect. Key words and phrases used within these databases

included: artificial rupture of membranes, labor dystocia, induction of labor, augmentation of labor, prolonged latent phase of labor, nulliparous labor induction, labor interventions, and early amniotomy.

Criteria for Inclusion and Exclusion

When determining the selections for this review of literature, it was determined that the primary focus would be placed not only on whether amniotomy is effective but if it is a safe intervention to perform for both mother and child. The goal of this literature review was to focus on early versus late amniotomy and further differentiated nulliparous versus multiparous. Inclusion criteria for this review was the use of amniotomy as an induction or augmentation method in multiparous and nulliparous women. Study groups were required to be term gestation with singleton, live fetus' with reassuring fetal heart tones, vertex presentation, and intact membranes. In addition, variables such as other induction methods used, demographics, and parity must be the same between the control groups, without amniotomy, and the amniotomy groups.

Several factors led to the exclusion of literary articles within this review. Most of these were excluded based upon their lack of substantial data or evidence in regards to this review or ability to be replicated within our current healthcare model. While some studies were excluded based on differences in how childbirth and labor management is performed, some foreign studies were included as relevant and similar care. Additional criteria for exclusion included age of the study over seven years and studies not in or translated to the English language.

Summary of Selected Studies

The twenty articles included in this review consist of two descriptive and comparative studies, ten blinded and non-blinded randomized controlled clinical trials and studies, five retrospective cohort studies, one correlation study, one longitudinal cohort study, and one prospective research study. The majority of studies were completed throughout the United States, Israel, and Canada. It also included one study from Lower Saxony Germany, one from Italy, one from Nigeria, and one from Iran. Included in this review are studies that were performed between 1989 to 2014.

Evaluation Criteria

The Johns Hopkins Research Evidence Appraisal Tool was used to classify the strength and quality of the articles in this review (Dearholt & Dang, 2012). They were all classified with a level I-III, per the appraisal tool. Level I signified randomized controlled trials or experimental studies. Thirteen of the twenty articles were Level I articles. Level II signified quasi experimental studies. Only one of the articles selected for this review was a level II. Level III articles were non-experimental. Six of the twenty articles in this review were level III articles.

After they were categorized into level I-III, they were classified with quality levels for each. Nineteen of the twenty articles used in this review were high quality studies. They had consistent results with a sufficient sample size, had a valid control, definitive conclusions, and consistent recommendations. Only one of the articles used was of good quality. Articles of good quality have reasonably consistent results, sufficient sample size, some control, and fairly definitive conclusions (Dearholt & Dang, 2012).

Chapter III: Literature Review and Analysis

Synthesis of Matrix

The matrix of articles selected for this review consisted of ten randomized controlled trials, five retrospective cohort studies, two descriptive and comparative studies, one longitudinal cohort study, one prospective research study, and one correlational study. Using John Hopkins Research Evidence Appraisal tool, the evidentiary level was appraised while contrasting the quality within the content of the study (Dearholt & Dang, 2012). The research selected was critiqued for accuracy, bias, and reproducibility using a strict methodology. The studies within this matrix were first interpreted and organized by their level of evidence but were then placed in alphabetical order to make it more convenient for cross referencing. Within this chapter, the findings of these studies are further interpreted and synthesized, while exploring populations of women that are most affected by amniotomy. Throughout this chapter, it will become more obvious as to how amniotomy affects not only labor progression but also both mother and child depending on their risk factors.

Synthesis of Major Findings

The twenty research articles selected for this review are focused on the efficacy and safety regarding amniotomy as a method for labor induction and/or augmentation and how this intervention affects the labor process. While the articles focused on different aspects of how amniotomy effects labor outcomes, the vast majority of current research found statistically significant differences in results between nulliparous and multiparous women. Another similarity that researchers across studies identified was that the timing at which amniotomy was performed and whether a woman was in an active labor pattern prior to rupture also impacted findings.

The role of parity. Parity is the obstetrical term used for the number of pregnancies a woman has carried to a viable gestational age. Much of the research within this review divides

women into the categories of being either nulliparous or multiparous. It is well-known within obstetrical care that multiparous women progress faster throughout labor than nulliparous women, but studies like these give us a greater understanding of why this occurs (Pasko, 2018).

Nulliparous women are often known to progress more slowly throughout the stages of labor (Pasko, 2018), but often healthcare providers are quick to label the labor as "stalled" and thus begin augmentation of labor. Many have theorized a labor curve for cervical dilatation that accelerates around five to six centimeters (cm), but it is now being shown that nulliparous women show no statistically significant acceleration at any point during cervical dilatation (Neal et al., 2014).

The use of artificial rupture of membranes as an induction or augmentation process in labor is no exception to these theories. Another study (N=925) showed that amniotomy is more effective in preventing labor dystocia when performed after the cervix is dilated three centimeters or more (Fraser, Margoux, Moutquin, & Christen, 1993). However, a newer study (n=300), showed that early amniotomy was effective in reducing both labor dystocia and cesarean section rates in nulliparous women (Ghafarzadeh, Moeininasab, & Namdari, 2015). Gross, et al. (2014) concluded that complications related to early amniotomy in nulliparous women were predominantly caused by amniotomy performed prior to adequate fetal descent or inappropriate fetal station. One study showed that the use of oxytocin and amniotomy together were more effective in nulliparous women in shortening labor (Fraser et al., 1993). This differs in multiparous women, who showed no difference between the group using amniotomy alone and the group that had both oxytocin and amniotomy (Nachum et al., 2010). Out of the thirteen studies that examined the effect of amniotomy on labor progression, seven included both multiparous and nulliparous women and six had nulliparity as an inclusion criteria (Ängeby et al., 2018; Bostanci et al., 2017; Cooney & Bastek, 2014; Fraser et al., 1993; Ghafarzadeh et al., 2015; Gross et al., 2014; Herman et al., 2018;

Macones et al., 2012; Makarem et al., 2013; Nachum et al., 2010; Onah et al., 2015; Petersen et al., 2013; Tam et al., 2013). Three of these studies showed a progression difference between multiparous and nulliparous women showing that multiparous progress faster with amniotomy (Angeby et al., 2018; Gross et al., 2014; Nachum et al., 2010). The study by Gross, Fromke, and Hecker (2014) included 2,090 nulliparous women and 1,873 multiparous women. This study concluded that when amniotomy and oxytocin were used together for augmentation or induction, the time between the performing of amniotomy and birth was 3.3 hours for nulliparous women and 1.4 hours for multiparous women (Gross et al. 2014). This suggests that amniotomy is more time effective in multiparous women than in nulliparous women but it is also important to remember that nulliparous women statistically take longer to progress through labor.

Latent vs. active labor. With the high rate of inductions in the United States, it is important to understand the difference between latent and active labor. This can be a confusing topic to consistently define, as a wide range of definitions have been utilized both historically and across the studies included in this review. Latent labor, also known as early labor, has been defined as cervical dilatation less than or equal to two centimeters with regular or irregular contractions (Rota et al., 2018). Some research takes this one step further by calling three centimeters latent labor. Once the patient reaches three to four centimeters with regular contractions, she is then defined as being in active labor (Gross et al., 2014). Nulliparous patients may remain in latent labor far longer than multiparous patients, even with cervical dilatations of three centimeters, four centimeters, or even five centimeters (Neal et al., 2014). Cervical exams alone do not validate latent versus active labor, as the contraction pattern should also be taken into consideration.

Latent labor can begin weeks before delivery and can be extremely uncomfortable. For nulliparous patients this can be alarming based on their lack of experience with the labor process and can cause more trips to the hospital or calls to their provider. A lengthy latent stage of labor

can begin the cascade of interventions to include amniotomy, epidurals, and intravenous pain medication administration (Ängeby et al., 2018). In a large study of over 1300 labors, Ängeby, Wilde-Larsson, Hildingsson, & Sandin-Bojö, showed that it is quite common for latent labor to last 18 hours or more in both nulliparous and multiparous women (2018). In this study, 23% of all women, over 29% of nulliparous women, and about 17 % of multiparous women had a labor 18 hours or greater (Angeby et al., 2018). With the rise of elective inductions, research also focused on the admission of patients in latent labor with an unfavorable cervix. It was found that 84.2% of these patients will require IV oxytocin, 12.3% of them will develop fevers between the time of amniotomy and delivery, and they averaged four hours longer of active labor than someone who presents in active labor (Neal et al., 2014). When looking at the role of parity in regards to amniotomy, a clear link exists that shows how nulliparous women usually progress much slower throughout labor; and when amniotomy is performed prior to active labor, it can stop the progression of labor (Gross et al., 2014). Throughout their study, Gross et al. (2014) found direct time related associations between time dependant interventions, like amniotomy, and the duration of labor and mode of birth. Within the same study, (n=1873), a 6.6-fold acceleration curve was found in multiparous patients after amniotomy was performed and that AROM increased the overall tendency for a spontaneous vaginal delivery in both nulliparae and parae (Gross et al., 2014). This curve worked in reverse for nulliparous patients when amnitomy was performed prior to active onset of labor.

Overall length of labor. There are countless factors that play a part in a woman's labor length. Some of these factors include parity, size of fetus, complications of this pregnancy, and pelvis size. Nine of the studies included in this review, including both multiparous and nulliparous women, showed a significantly shorter length of labor by use of artificial rupture of membranes, and five of these studies demonstrated decreases in the length of labor by two hours or more

(Bostanci et al., 2017; Cooney & Bastek, 2014; Fraser et al., 1993; Ghafarzadeh et al., 2015; Gross et al., 2014; Macones, Cahill, Stamilio, Odibo, 2012; Makarem et al., 2013; Onah, Dim, Nwagha, & Ozumba, 2015; Tam, Conte, Schuler, Malang, & Roque, 2013).

While one study showed that amniotomy reduces the need for oxytocin use (Onah et al., 2015), another study showed that the combination of artificial rupture of membranes along with the use of oxytocin is most effective in shortening labor in women with a prolonged latent stage of labor in both nulliparous and multiparous women (Nachum et al., 2010). The common theme also suggests that amniotomy is most effective and safest when done after three centimeters and already in regular contraction pattern regardless of parity (Cooney & Bastek, 2014; Fraser et al., 1993; Tam et al., 2013). The key study that paved the way for amniotomy research was a randomized control study conducted by Fraser et al. (1993). This study included 925 nulliparous women who were 38 weeks of gestation or higher, in spontaneous labor, with a singleton fetus, in cephalic presentation, normal fetal heart tones, with fetal head applied to cervix (Fraser et al., 1993). This study found that amniotomy was more effective in labor progression and decreased the dystocia rate in nulliparous women, as opposed to multiparous women (34% vs. 45%; RR: 0.8; 95% CI: 0.6 to 0.9), when dilation was greater than three centimeters (Fraser et al., 1993).

Associated complications. Complications in labor can arise with or without interventions, but the literature used for this review shows a mixed stance on whether amniotomy causes harm. Cesarean sections, labor dystocia, and maternal fever were three common complication trends that were studied, and the results were mixed depending on a number of factors.

Cesarean sections. With over one third of all women delivering via cesarean section in the United States, according to the Centers for Disease Control (2017), it is always important to determine if an intervention raises the risk for this major abdominal surgery. Cooney and Bastek

(2014) performed a randomized control trial on 1,597 nulliparous women, admitted for induction of labor at term gestation. This study concluded that when amniotomy is performed at three centimeters or less, the risk for cesarean increases by over 10% (40.2% vs. 29.5%, $p < 0.001$) (Cooney & Bastek, 2014). While this one study in this review did find an increased risk, seven studies found no increased risk for cesareans that can be linked to the intervention of amniotomy (Angeby et al., 2018; Bostanci et al., 2017; Cooney & Bastek, 2014; Fraser et al., 1993; Ghafarzadeh et al., 2015; Kuper et al., 2017; Macones et al., 2012; Makarem et al., 2013; Mei Dan et al., 2017; Neal et al., 2014; Pasko et al., 2018; Rota et al., 2018; Selo et al., 2008). In fact, one randomized control clinical trial of 300 nulliparous women with term gestations set out to find this answer (Ghafarzadeh, Moeininasab, & Namdari, 2015). Their trial put women into two categories: the amniotomy (experimental) group and the no amniotomy (control) group. There were 150 women placed in each group. This study showed that performing an amniotomy actually decreased the chances of a cesarean section by 81.7% (Ghafarzadeh, Moeininasab, & Namdari, 2015). Fraser et al. (1993) also concluded that amniotomy did not increase the overall risk of cesarean section, but did increase the risk of a cesarean section being due to fetal distress post amniotomy. In regards to parity, it was also found by Gross et al. that 14.2% of nulliparous patients will deliver by cesarean section if amniotomy is performed in the first stage of labor (2014). Compared to 3.4% of multiparous women, this just shows that nulliparous patients must be given additional time to ensure active labor is in process. In conclusion, this review has found no statistically significant rise in cesarean section rates when amniotomy is performed once an active labor pattern is established.

Labor dystocia. Stalled labor, also known as labor dystocia, is when the labor process slows or halts. This diagnosis is commonly given to nulliparous women who have failed to make adequate cervical change. Labor dystocia was defined by Fraser et al. (1993) as a period of at

least four hours after dilation to three centimeters, in which the mean rate of cervical dilation was less than .5 centimeters per hour. The outcome of that study determined that an early amniotomy, done prior to three centimeters, was effective in reducing the dystocia rate by 15% (Fraser et al., 1993). Fraser et al. (1993) concluded that in the amniotomy group performed after three centimeters patients had a labor dystocia rate of 33%, while those done before three centimeters was 36%. The dystocia rate was higher in those women not in the amniotomy group, at 48% (Fraser et al., 1993). A more recent study by Ghafarzadah et al. (2015) verified the reduction in labor dystocia rates found by Fraser et al. In their randomized clinical trial of 300 nulliparous, women, labor dystocia was decreased by 80.6% (95%, $p < 0.001$, CI: 58.6-90.1%) in women who received an amniotomy (Ghafarzadah et al., 2015).

Maternal fever. When a patient becomes febrile during labor without any known infection processes, there is a concern for chorioamnionitis. One of the greatest factors clinicians use to determine a woman's risk is to look at the total hours since the rupture of membranes occurred, which will often correlate with elevated body temperatures. Of the four studies in this review that measured chorioamnionitis or fevers, two concluded that maternal fever rates are not higher when AROM is performed in active labor (Bostanci et al., 2017; Makarem et al., 2013). Neal et al. further concluded that 12.3% of women who have amniotomies prior to active labor will become febrile compared to 4.9% for those who have an amniotomy in active labor (2014). One randomized control study, Nachum et al.(2010) studied 213 women with term pregnancies diagnosed with prolonged latent stage of labor, and they concluded that amniotomy resulted in increased rates of fever and intrapartum antibiotics ($p = 0.03$).

Neonatal outcomes. One of the greatest concerns with any labor intervention is what effect it could have on the newborn. All four studies in this review that noted neonatal outcomes

concluded that there is no link between amniotomy in either early or active labor and neonatal outcomes (Cooney & Bastek, 2014; Fraser et al., 1993; Makarem et al., 2013; Onah et al., 2015).

Special populations. While much of the labor process remains similar among women, certain pregnancy populations present unique risks related to the intervention of amniotomy. Many of these special populations are considered high risk because of maternal comorbidities.

Multiples. Only one study within this review evaluated the potential risks associated with amniotomy within twin labors. This large randomized control trial performed in Canada on twin mothers found that amniotomy along with intravenous oxytocin was found to not increase the rates of cesareans during twin inductions or augmentations (Mei-Dan et al., 2017). Boasting a large sample size of over 1,400 women, Mei-Dan et al. (2017) further divided these women into two groups: those receiving prostaglandins alone for cervical ripening and those who used intravenous oxytocin along with amniotomy. The results showed no statically significant rise in cesarean sections within the group using oxytocin and amniotomy to induce labor (Mei-Dan et al., 2017).

Maternal obesity. With the increase in rise of obesity within the United States, new challenges are present that need special consideration. Three articles selected for this review specifically examined the difference that exists for obese women during labor. Obese nulliparous women have been shown to have a higher rate of cesarean sections and respond less favorably to synthetic oxytocin and artificial rupture of membranes (Carlson, Corwin, & Lowe, 2017). Carlson et al. (2017) identified eight risk variables that were shown to increase the risk of cesarean sections in obese nulliparous patients including: non-partnered status, minority status, nicotine use throughout pregnancy, alcohol consumption, illegal drug use, major chronic diseases (renal, liver, minor cardiac), minor chronic illness (autoimmune disorders, pulmonary disease, bleeding disorders), and psychosocial complications. Preactive labor admissions were

significantly higher in women with higher body mass index, which correlates to a longer duration from rupture of membranes to delivery (Neal et al., 2014). One study specifically looked at 285 women with class III obesity and found that there was a link between early amniotomy and various adverse outcomes in women who required an induction of labor (Pasko et al., 2018). In contrast, amniotomy performed once the patient had reached four centimeters and was in active labor led to a significantly lower cesarean section rate (OR: 2.34; 95% Cl: 1.43-3.84) when compared to the early amniotomy group (Pasko et al., 2018). The research currently available concludes that obese, nulliparous women's risk for cesarean increases by 5% for each unit increase in her mass BMI (Neal et al., 2014). In conclusion, obese women are found to respond less favorably to interventions like amniotomy and have an increased risk of cesarean section rate when performed prior to an active labor pattern (Neal et al., 2014, Pasko et al., 2018, Carlson et al., 2017). Nulliparous women are especially vulnerable and special consideration and extra time should be afforded.

Preterm. Preterm inductions are indicated for women who have a medical necessity to deliver their infant prior to the thirty seventh week of gestation. An induction of a preterm patient comes with different risk factors and labor progression than in a term induction. A woman's body is not typically ready to deliver her baby at earlier gestations, making induction a longer and harder process.

One study focused primarily on preterm labor and the differences that exist within this group of patients. In this study, a total of 149 women requiring preterm medical induction between 23-34 weeks were studied for how early artificial rupture of membranes affected their labor progression (Kuper et al, 2017). Within this population, labor dystocia and cesarean section rates were significantly higher than full term patients (Kuper et al, 2017). Kuper et al. (2017) determined that early amniotomy in a preterm patient is associated with a higher risk of cesarean

section and increases the time period from the initiation of the induction to delivery (25.7 ± 13.0 vs. 19.0 ± 10.3 hours, $p < 0.01$). This study also concluded that early amniotomy was not associated with any increased risks of developing chorioamnionitis during labor or other adverse maternal or fetal outcomes (Kuper et al., 2017). However, more studies would need to be done to create a practice guideline on induction of labor in preterm patients.

Summary

In conclusion, the vast amount of research shows that amniotomy is an effective intervention for reducing length of labor in many populations without necessarily increasing the risk of adverse reactions. The researchers were all primarily in agreement that active labor should be in progress and the patient should be three to four centimeters or greater when amniotomy is performed in order to reduce the negative effects of labor dystocia and cesarean sections. Focus should be placed on the parity of the patient. Amniotomy is more effective in multiparous women, so nulliparous patients should be given more time to progress throughout the stages of labor before considering the use of an intervention like amniotomy for augmentation.

Chapter IV: Discussion, Implications and Conclusions

The sole purpose of this literary review was to determine the safety and efficacy of the routine use of amniotomy during spontaneous, induced, or augmented labor progression. Using the Johns Hopkins Research Evidence Appraisal Tool, the 20 selected studies were critically analyzed to determine their overall level of quality. Throughout this review, many interesting findings were discovered that can contribute to the practice of nurse-midwifery. Those findings will be further discussed throughout this chapter. All of this will be compounded using Betty Neuman's System Model to explain further why internal and external forces heavily affect labor outcomes, especially when interventions are performed.

Literature Synthesis

The reason for this critical literature review was to determine outcomes of labors with the use of amniotomy. When formulating guidelines and practice bulletins, it is important to advocate for evidence based practice throughout each clinical practice. Many different studies were reviewed for accuracy, and this review concluded that there are various benefits to the use of amniotomy in shortening labor, however the risks exist especially within nulliparous women who are not in active labor. Regarding the admission of women in latent labor, Neal et al. (2014) found that 84% require IV oxytocin, 12.3% become febrile throughout labor, and that they are at a significantly increased risk for a cesarean section (95% CI, 1.02-6.37). However, only 45% of women admitted in active labor were augmented with oxytocin in the same study (Neal et al., 2014)

In regards to labor progression, eight of the twenty articles specifically concluded that the use of amniotomy shortened labor by two or more hours, while all 20 of the articles being reviewed showed a statistically significant shortening of labor (Bostanci et al., 2017; Cooney & Bastek, 2014; Fraser et al., 1993; Ghafarzadeh et al., 2015; Gross et al., 2014; Macones, Cahill,

Stamilio, Odibo, 2012; Makarem et al., 2013; Onah, Dim, Nwagha, & Ozumba, 2015; Tam, Conte, Schuler, Malang, & Roque, 2013). One dated study was even verified by a newer one that showed that amniotomy can be effective in preventing labor dystocia (Fraser et al., 1993; Ghafarzadeh et al., 2015). According to current studies, it is most appropriate to perform the amniotomy after three centimeters to aid in labor progression without causing further complications, and the procedure may be more effective with the use of oxytocin (Cooney & Bastek, 2014; Fraser et al., 1993; Onah et al., 2015; Tam et al., 2013).

The results of this literature synthesis regarding potential complications related to an amniotomy are inconclusive, as studies did not all arrive at the same conclusions. While seven of the studies reviewed mention higher rates of cesarean sections associated with amniotomy in early or latent stages of labor, four studies that showed the rates of cesarean sections were the same and one that showed the cesarean rates were even lower (Angeby et al., 2018; Bostanci et al., 2017; Cooney & Bastek, 2014; Fraser et al., 1993; Ghafarzadeh, Moeininasab, & Namdari, 2015; Kuper et al., 2017; Macones et al., 2012; Mei Dan et al., 2017; Neal et al., 2014; Pasko et al., 2018; Rota et al., 2018; Selo et al., 2008). While many of these studies concluded that early amniotomy can increase risk of cesarean section, all, but one (Fraser et al., 1993), of these studies concluded that there was no change in cesarean section rate when the amniotomy was performed after three to four centimeters.

Current Trends and Gaps in Literature

The procedure of artificially rupturing a woman's amniotic membranes while in labor, or as an induction method, was adopted over 50 years ago without solid evidence and benefit to risk ratio (Cohain, 2013). Over the last few decades many studies have been completed on the effects

of routine amniotomies, and it is easy to identify trends and gaps that exist. One of the earliest studies conducted between 1989 and 1991 examined amniotomy and whether benefits outweigh the risks (Fraser et al., 1993). This study was key to providing evidence based practice and providing the risks of the procedure, as well as pushing for future research on the use of artificial rupture of membranes. The main focus of initial studies done on amniotomies was the direct effect it had on the prevention of labor dystocia. Much of this early research was intended more to determine whether it could hasten labor and move one step closer to putting a time on labor progression. Unfortunately, each labor is different and later research found that amniotomy was not necessarily the biggest factor, wheres as fetal position and station was the determining factor in assessing labor progression.

As previously stated, most research still focuses on labor dystocia with the goal of determining overall changes in labor length. With limited information on the effects and risks of amniotomy on neonatal outcomes, prolapsed cord, and chorioamnionitis, additional research is necessary in order to ensure that amniotomy would not cause more harm than good. While many of the study included cesarean section, results varied between different studies and therefore more research is necessary to gain a consistent result. This triggered the recommendation for further studies that will address these risks as a key part of their study.

Despite the large amount of research and studies available on amniotomies, the practice is still being performed without solid evidence of risks associated. While the benefits of the procedure to progress labor at a faster rate are well documented, gaps also still remain in the use of amniotomy as an independent variable. Most studies were done on women that may have had oxytocin or other added forms of induction or augmentation that may skew the results as different nurses and providers will titrate the medication differently, changing the outcome of the labor.

Since there are limited studies on special populations of women, more randomized clinical trials would be necessary to conclude appropriate risk to benefits on performing an amniotomy on these populations. Some populations of women that need to be further studies in the use of amniotomies include multiple gestation, diabetic, hypertensive and pre-eclamptic, preterm, oligohydramnios and polyhydramnios, and trial of labor after cesarean section. These high risk populations of pregnant women have special circumstances that may affect the labor course, and therefore need studies to specifically address the use of amniotomy within the associated risk factors.

Implications for Midwifery Practice

What historically sets midwives apart from obstetricians is their "hands off" approach and ability to provide holistic care. The midwifery model views childbirth not as an illness but rather as a normal function. For various reasons, nurse-midwives find themselves in situations where medical interventions are necessary, so it is important to understand the safest time and situation to perform the intervention. Amniotomy is performed for a variety of reasons and some of these reasons are found to be validated based on clinical signs by either the mother or child.

One mindset that sets midwives apart is the belief that labor is a natural occurrence that occurs to complete the pregnancy and bring a new life into the world. While complications can occur in any labor and it is important to know abnormalities, it is imperative to understand the physiological process that occurs and why the membranes serve a vital role. The chorion is a layer of protection that exists between the amnion and the cervix. Prostaglandin dehydrogenase (PDHG) is an enzyme that is produced by the chorion that helps eliminate prostaglandin PGE2, which is directly responsible for ripening the cervix. It is thought that the constant contact between the chorion and the already opening cervix as it begins to dilate and efface it produces less PDHG (Smyth et.al., 2013). The pressure from the intact membranes places a constant and

equal pressure on the entire cervix while maintaining the natural barrier for both mother and child. This further allows the body to dilate and efface the cervix and begin preparing for labor. When the amnion is ruptured prior to adequate cervical ripening, it can slow down labor or stop it all together, which was observed in many studies selected for this review (Carlson et al., 2017; Cooney & Bastek, 2014; Fraser et al., 1993; Onah et al., 2015; Tam et al., 2013).

Based on the finding of this literature review amniotomy is effective in shortening labor, and the most optimal timing of amniotomy for progression of labor would be a multiparous woman with labor progressing past four centimeters (Bostanci et al., 2017; Cooney & Bastek, 2014; Fraser et al., 1993; Ghafarzadeh et al., 2015; Gross et al., 2014; Macones, Cahill, Stamilio, Odibo, 2012; Makarem et al., 2013; Onah, Dim, Nwagha, & Ozumba, 2015; Tam, Conte, Schuler, Malang, & Roque, 2013). However, amniotomy is also effective in nulliparous women with slowed progress and as an added induction method, only when the cervix is favorable. Current research shows that performing prior to a favorable cervix increases the risk of cesarean section (Angeby et al., 2018; Cooney & Bastek, 2014; Fraser et al., 1993; Kuper et al., 2017; Neal et al., 2014; Pasko et al., 2018; Rota et al, 2018).

The knowledge and understanding of how the labor process works and the intricate and sometimes unknown processes are extremely important to successful labor. The cascade of hormonal shifts causes one hormone to affect another. This is seen throughout the entire reproductive cycle and when one hormone is out of range the entire process can become altered. The majority of the evidence for this review did concur that amniotomy accelerates the labor process, but only when done at the correct time. Performing this intervention too soon could cause worsening labor dystocia.

Recommendations for Future Research

Current increasing rates of cesarean sections have brought to light the risk and benefits of all procedures performed during labor. The effects of an intervention, like amniotomy, are felt by both the mother and child, so it is critical that the intervention does not favor one and harm the other. The benefits to a positive labor progression by use of an artificial rupture of membranes are clearly identified throughout the majority of literature used for this review. While amniotomy is proven to shorten labor by two or more hours, the risks are lower in those that meet certain criteria. Those who are in an active labor pattern and making cervical change can benefit from a shorter labor if amniotomy is performed. The risks associated with amniotomy is shown, through the research, to increase significantly in nulliparous women who are not in active labor. Recommendations for future research would include studying each risk as an independent variable to identify statistical differences between different populations. The risks that need further evaluation and research include the risks of cesarean section, chorioamnionitis, prolapsed cord, maternal pain, and neonatal outcomes including sepsis.

It would also be beneficial to conduct studies using amniotomy as an independent variable. The majority of current research add variables of other induction methods, such as pitocin and cytotec, but few have utilized amniotomy as a sole method of induction or augmentation. The multivariate nature of many of these studies, makes it difficult to determine whether amniotomy was independently responsible for either the decrease in labor time or the increase in labor complications. Each variable added to the research makes it more difficult to accurately conclude whether routine amniotomy is safe and effective.

One topic that widely differs throughout the research and current practice is the objective assessments that warrant admission to an obstetrical unit with anticipation for delivery. The research used for this review primarily studied low risk women with little or no major health complications. Because true labor dystocia is considered a clinical reason to further augment

labor with amniotomy or other obstetrical interventions, it is necessary to further research admission requirements for labor and when active labor truly begins. If the hope is to reduce interventions, it is extremely important to examine whether the current system of premature admission in labor is to blame rather than lack of cervical change. Research has shown that primiparous patients have a much longer latent labor, as the body is preparing itself for active labor and delivery. While most facilities, providers, and obstetrical nurses understand the statistical time differences between most multiparous and nulliparous women, most policies and guidelines do not differentiate between the two. This causes some multiparous women to appear as precipitous and some nulliparous women to appear as experiencing labor dystocia, when in fact it is normal for these differences.

Integration of Betty Neuman's Nursing Theory

Betty Neumann developed the System's Model to explain how various stressors can impact various outcomes and how different lines of defense exists to protect us from further harm. It is through this nursing theory that nursing has come to adapt care to a prevention based system rather than solely treating symptoms. To further understand this model and how it relates to the labor intervention of amniotomy, it is important to comprehend the lines of resistance that occur within the body to maintain the equilibrium that occurs during pregnancy and childbirth.

The female body was intelligently designed to not only conceive and carry a child but also vaginally deliver that child. Medical complications come when the equilibrium of the pregnancy is disrupted by internal or external forces. This could be a variant within the mother or child or could be an external cause that the body was not prepared for. When labor is induced using synthetic hormones, mechanical cervical dilatation, or artificial rupture of membranes, the body begins to react in various ways. The hope with these inductions is that changes will occur within the cervix based on the intensifying contractions. Research has shown us that this works

more often with multiparous women but often nulliparous pre-labor patients are not so fortunate.

Amniotomy is one labor intervention that cannot be undone and once it is performed the countdown to delivery begins. The normal line of defense that exists to protect both mother and child is the amniotic sac. Once broken, the final line of defense for bacteria is broken and the risk for infection becomes a potential issue that necessitates action towards delivery. The bag of waters also protects the unborn child from trauma caused by cord compression. All of these are legitimate concerns that can and do happen once amniotomy is performed. Chorioamnionitis is an infection that occurs when bacteria travels through the vagina and infects the membranes within the uterus. This infection can cause a variety of complications for both mother and child, which require further necessary medical interventions such as intravenous antibiotics. A woman can develop chorioamnionitis even if her membranes rupture spontaneously, but often when the membranes rupture it is caused by strong, frequent contractions and a rapidly dilating cervix. The same is true with the incidence of umbilical cord prolapse. The amniotic sac is designed as a strong, flexible protective barrier that will break with strong, frequent contractions that cause the fetal head (or other presenting part) to put downward pressure through the cervix. As the amniotic sac bulges through the cervix, it will eventually rupture. When the head is well applied, the concern for prolapse is mostly eliminated. It is obvious that the cervix and amniotic sac work together to provide this primary level of preventative defense.

Neuman's model heavily relies on the idea that environments are responsible for a variety of outcomes. In the United States alone, almost 24% of all singleton pregnancies are induced (Osterman & Martin, 2014). Created environments are explained within The System's Model as a way to show the link that the environments created have a large impact on one's internal and external environment (Neuman, 2011). In a nation where a quarter of all pregnancies are induced, is it any wonder why cesarean sections have drastically risen? An environment of

normalcy needs to be established once again. Childbirth has been an act that has existed since the first humans walked this earth but somehow with the advanced understanding of science, many believe that it can be controlled. Labor must be viewed as a normal physiologic function if the hope for equilibrium is ever desired.

While there are risks associated with any intervention, when performed correctly amniotomy can shorten labor duration and allow progression to occur at a quicker pace. Informed choice is an important component of healthcare and is pivotal within midwifery. Women need to be educated about the benefits and risks and the provider must do so in a non judgemental way. Neuman's Systems Model emphasizes the word "stressor" as a way to bring change but a stressor is not necessarily a negative. In the case of amniotomy, the stressor (which is the intervention) can shorten labor and reduce cesarean section rates when done at the proper time.

Conclusion

Throughout the research presented within this case review, it can be concluded that the labor intervention of amniotomy is relatively low risk for patients already in an active labor pattern. Many of the complications that occur are the result of artificially rupturing the membranes prior to active labor and without correct fetal engagement. Amniotomy during active labor is shown in research to decrease overall labor time. It is clear that this intervention has its time and place. With regards to nulliparous patients, extra time and patience should be afforded as labor dystocia is often called too soon, sometimes before the patient is even in active labor. Providers should be slow to admit patients where active labor is not apparent.

Nurse-midwives must recognize that labor is a normal physiologic function that does not always operate on schedules and policies. As long as mother and child are tolerating labor, time should be given to allow the body to progress on its own. When medically indicated and

appropriate, amniotomy is an effective tool to use but should be used only when active labor has begun. With such limited research on risks of amniotomy, as an advocate for low risk women, it should be used as only a tool, when needed, to aid in labor progression. More research on risks should be studied prior to using it routinely. The best time to use amniotomy is in cases of stalled labors or patients needing quicker delivery related to a high risk pregnancy.

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Appendix 1 – Literature Review Matrix

<table>
<tr><td colspan="4">Source: Ängeby, K., Wilde-Larsson, B., Hildingsson, I., & Sandin-Bojö, A. (2018). Prevalence of prolonged latent phase and labor outcomes: Review of birth records in a swedish population. Journal of Midwifery & Womens Health, 63(1), 33-44. doi:10.1111/jmwh.12704</td></tr>
<tr><td>Purpose/Sample</td><td>Design (Method/Instruments)</td><td>Results</td><td>Strengths/Limitations</td></tr>
<tr><td>Purpose:
To describe the prevalence of the prolonged latent phase totalling 18 hours or more and the interventions and outcomes that resulted.
Sample/Setting:
1343 electronic birth records for women admitted for spontaneous labor over 37 weeks. Exclusion criteria was: multiple gestation, induced labors, cesarean birth, stillborn births, non-Swedish speaking patients, and those who delivered outside of the hospital.
Setting: a midsize Hospital in Western Sweden
Level of evidence:
Level III
Quality of evidence:
High quality</td><td>Descriptive and Comparative Study
Women were asked during prenatal visits about an ongoing study by their antenatal midwife. Once admitted to the hospital, the midwife then obtained written consent to review their final birth record. A test pilot was performed and a strong inter-observer agreement was found. Background data and characteristics, medical interventions, and labor/neonatal outcomes were compared between women with true latent phases lasting 18 hours or longer and those with latent phases less than 18 hours, based solely on the women’s self report of labor start time.
Instrument:
Data was analyzed using descriptive statistics and a chi-square test for dichotomous variables. The analysis utilized the Statistical Package for Social Sciences version 21.0.</td><td><u>Greater than 18 hours-</u>
-23% of all patients
-29.2% of all nulliparous
-17% of all multiparous
-Higher rate after having amniotomy in early or latent labor.
-More IV and epidural analgesia

<u>Less than 18 hours-</u>
-lower cesarean sections
-lower in multiparous patients
-significantly shorter active phase of labor
Conclusion:
Hospital distance, length of pregnancy, and childbirth fears were not found to be associated with latent phase length. The women’s perception of when true labor begins is vital as it has a cascading effect on pain control, obstetrical interventions, and cesarean sections.</td><td>Strengths:
-All women and providers informed in advance regarding the future review of the records.
-Sample consisted of 48% nulliparous. Most years nulliparous births account for 41% of births.
Limitations:
-This type of review of birth records could have limitations because documented interventions might not exactly match the ones performed.
-Exclusion of non-Swedish speaking women.
-Sweden has an extremely low cesarean section rate so replication in other countries might be hard.</td></tr>
<tr><td colspan="4">Author Recommendations:
In order to provide a safe and woman centered care model, it is important to identify true prolonged labor compared to those who are labeled prolonged based on early admission to the hospital.</td></tr>
<tr><td colspan="4">Summary for current clinical practice question: A prolonged latent phase is highly associated with early labor admittance to the hospital, higher rate of obstetrical interventions, epidural and IV analgesia, and</td></tr>
</table>

cesarean births. Nulliparous patients have a longer than previously thought time from the latent phase to delivery.

Source: Bostancı, E., Eser, A., Yayla Abide, C., Kilicci, C., & Kucukbas, M. (2017). Early amniotomy after dinoprostone insert used for the induction of labor: A randomized clinical trial. *The Journal of Maternal-Fetal & Neonatal Medicine, 31*(1-12). doi:10.1080/14767058.2017.1285893.			
Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To assess whether early amniotomy, after cervical ripening with dinoprostone, in any way reduces the total duration of labor. **Sample/Setting:** 200 consenting adult women with singleton, term gestations (over 37 weeks), cephalic presentations with intact amniotic sac, and a medical induction for an induction of labor. 100 women in each group. **Setting**: Zeynep Kamil Maternal and Children's Training and Research Hospital in Istanbul, Turkey. **Level of evidence:** Level 2 (Randomized controlled clinical trial) **Quality of evidence:** High Quality	Randomized controlled clinical trial. Patients were randomly assigned to one of two groups: early amniotomy (artificial at 3cm) or standard amniotomy (spontaneous). All patients were monitored with continuous fetal monitoring. <u>Early amniotomy:</u> - Received a vaginal insert of 10mg dinoprostone at a rate of 0.3mg/h over 12 hours -AROM performed at 3cm dilatation. <u>Standard management:</u> -Received the same dinoprostone 10mg vaginal insert. -SROM occurs spontaneously.	<u>Early amniotomy:</u> -79 women delivered within 24 hours with an average labor duration being 13.72 hours. -Average time from start of induction to delivery was shortened by more than two hours. -no increased risk for cesarean section. -latent and active labor time was quicker than standard management. <u>Standard management:</u> -35 women delivered within 24 hours with the average labor during being 22.73 hours. -chorioamnionitis and maternal fever were similar in both groups. There was no significant difference in the need for a cesarean section between the two groups. **Conclusion:** This study only expanded upon the current research that showed that early amniotomy is not only safe after receiving dinoprostone but it significantly decreased the length of labor without increasing the rate of cesarean section.	**Strengths:** -Subjects were randomly assigned. -Validated previous findings. **Limitations:** **-small sample size** -Neither the physician or participants were blind to the treatment group. -The trial was only performed in one hospital.
Author Recommendations: The author recommended that early amniotomy immediately following vaginal prostaglandins should be used to decrease the overall length of labor.			
Summary for current clinical practice question: Early amniotomy after cervical ripening with dinoprostone decreases the length of labor without increasing the rate of cesareans.			

<table>
<tr><td colspan="4">Source:Carlson, N. S., Corwin, E. J., & Lowe, N. K. (2017). Labor intervention and outcomes in women who are nulliparous and obese: Comparison of nurse-midwife to obstetrician intrapartum care. Journal of Midwifery & Womens Health, 62(1), 29-39. doi:10.1111/jmwh.12579</td></tr>
<tr><td>Purpose/Sample</td><td>Design (Method/Instruments)</td><td>Results</td><td>Strengths/Limitations</td></tr>
<tr><td>Purpose:
To see if there is any statistical data or difference between care provided by a doctor or nurse-midwife to obese nulliparous women in active spontaneous labor.

Sample/Setting:
400 obese nulliparous women

Setting: University of Colorado Hospital

Level of evidence: Level III

Quality of evidence: High</td><td>Retrospective cohort study. Started with over 8000 participants and 7,889 were excluded because they failed to meet criteria. Compared 2 propensity score-matched groups of women in good health status, first pregnancy, obese, and in active-spontaneous labor. The labor itself was managed by either a certified nurse midwife or an obstetrician at one hospital between 2005-2012. These comparisons were then ranged to see labor progress and outcomes.

Instruments:
Pearsons’ 2-sided chi-square test to compare demographic data. REDCap was used to obtain detailed medical records.</td><td>Nurse-Midwife
-More likely to go into spontaneous labor between 40 0/7 and 40 6/7.
-significantly fewer admitted to hospital less than 4cm.
-less likely to use oxytocin aug, epidurals, and IUPCs.
-significantly less third and fourth degree tears.
-longer interval between AROM.
-hydrotherapy significantly avoided or delayed high-tech labor interventions.
Obstetrician
-quicker to progress from 4cm-complete.
-quicker to start oxytocin augmentation.
Conclusion:
Even though the CNM group had a longer active labor phase, there was no difference in maternal temp, infection, but did have a significantly lower rate of third and fourth degree lacerations.</td><td>Strengths:

Propensity score matching.

High number of exclusions.

Limitations:
Retrospective design.

Bias in selecting the members of each cohort based on group allocation.

Generalizability since this facility has a lower than average cesarean rate.

Excluded women who were higher risk or did not have adequate prenatal care.</td></tr>
<tr><td colspan="4">Author Recommendations: A prospective study of labor is needed. Watchful waiting along with physiological interventions (intermittent monitoring, ambulating, hydrotherapy) are shown to be beneficial in reducing the need for medical interventions that are associated with higher rates of maternal and fetal complications.</td></tr>
<tr><td colspan="4">Summary for current clinical practice question:
Giving women time to dilate, labor, and progress without performing unnecessary interventions is a benefit that is shown by lower rates of oxytocin, epidurals, IUPC’s, and 3rd-4th degree lacerations.</td></tr>
</table>

Source: Cooney, L., Bastek, J. (2014). The association between early and artificial amniotomy and chorioamnionitis in nulliparous induction of labor. *International Scholarly Research Notices, 2014*. doi:10.1155/2014/628452. Link: https://www.ncbi.nlm.nih.gov/pubmed/27379338			
Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: The purpose of this article was to find and study if early amniotomy would increase the rate of chorioamnionitis, decrease time to vaginal delivery, and/or increase the risk of cesarean section. **Sample/Setting:** Sample: -1,567 women met criteria and were included in the study. -Nulliparous - Admitted for induction of labor - intact membranes - Term gestation. Setting: Study was conducted between January 2008 and December 2011 at an urban tertiary care center. **Johns Hopkins Evidence Appraisal:** Level 1 **Quality:** Level A: High quality	Randomized Control Study **Method:** Women were either placed in the "early artificial amniotomy" group or the control, "unexposed" group. Demographics and pre-existing medication conditions were well balanced between the two groups. Both groups had similar indications for induction. Early Artificial Amniotomy: The 398 participants in this group had their membranes artificially ruptured at a median of 3cm. Unexposed: The 1,169 participants in this group had a median amniotomy at 4.5cm. 80.4% of the women in this group had artificial amniotomy, while 19.6 had a spontaneous amniotomy at greater than 4cm. **Instruments:** Centricity Perinatal database was used to track deliveries during the study. The delivering physician entered delivery information into a separate electronic database.	-There was a significant decrease (57.5%) in the rate of chorioamnionitis in the early amniotomy group of the women who delivered vaginally. -In vaginal deliveries, there was a 2 hour and 20min decrease in time from 4cm to delivery in women with early amniotomy compared to those without. -The rate of cesarean section was increased in the early amniotomy group (40.2%) versus the patients without (29.5%). -No significant difference in neonatal outcomes between the early amniotomy group and those without. **Conclusion:** -Early amniotomy in inductions does not increase the risk of chorioamnionitis. It actually lessened this risk significantly in those with vaginal deliveries. -Early amniotomy decreases the length of labor in nulliparous women. -Early amniotomy increases the risk of cesarean section. -Early amniotomy does not affect neonatal outcomes.	**Strengths:** -Well-balanced in demographics, pre-existing medical conditions, GBS, reasons for inductions. -Author describes all necessary terms that may be defined differently in different institutions. -Reliable databases were used to compile data. -"Largest cohort of nulliparous women studied to date and the first to be powered to the rate of chorioamnionitis as primary outcome" (p.5). -A great amount of consistency since all the study participants were in the same facility. -Great reproducibility. **Limitations:** -Sample sizes were not completely equal. There were 1,169 in the unexposed group, while there were only 398 in the early amniotomy group. -Decision to perform early amniotomy was based on physician's preference, which may have been a bias that influenced results. -Definitions of chorioamnionitis were not based on lab cultures obtained.

Author Recommendations: Although there is no "author recommendations" section, they do mention that they study the length of time between the intervention and delivery instead of how they studied it (between 4cm and delivery).
Implications: There are both benefits and risks to performing early amniotomy. It may have no effect on chorioamnionitis, but it may increase the risk of cesarean section delivery. It does significantly reduce the time in labor, which is consistent with other studies. More research needs to be done to verify if this is a risk of early amniotomy. It may be helpful to perform artificial amniotomy when attempting to reduce the length of labor, but possibly should not be done prior to 4cm due to the increased risk of cesarean section.

Source: Fraser, W.D., Margoux, S., Moutquin, J-M., & Christen, A. (1993). Effect of early amniotomy on the risk of dystocia in nulliparous women. *The New England Journal of Medicine, 328*(16). doi:10.1056/NEJM199304223281602

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: The purpose of this study was to determine if routine early amniotomy reduced the risk of labor dystocia for nulliparous women in spontaneous labor. **Sample/Setting:** Sample: 925 nulliparous women in labor were included in this study Inclusion criteria: -Nulliparous. -38 weeks gestation or more. -In spontaneous labor. -Single fetus, cephalic. -Intact membranes. -Normal FHTs. -Fetal head applied to cervix. Setting: -This study was carried out in 11 university-affiliated teaching hospitals (10 in Canada and 1 in the US) from October 1989-April 1991. **Level of evidence:** Level 1 (Experimental) **Quality of evidence:** High Quality	Randomized Control Method: -Women were stratified according to their cervical dilation and then randomly assigned to either the amniotomy group or conservative management group. -Dystocia was defined as a period of at least four hours after dilation to 3cm, which the mean rate of cervical dilation was less than .5cm/hour. Amniotomy: -AROM was conducted immediately after random assignment. Conservative: -AROM was avoided unless medically indicated. **Instruments:** -Telephone answering service used for randomization. -Sterile plastic hook used to AROM.	Amniotomy: -Average time from randomization to complete dilation was 277 minutes. -Amniotomy was more effective in speeding up labor in those with >3cm dilation. -33% dystocia rate in those with >3cm dilation. -36% dystocia rate in those <3cm. -36% needed oxytocin. Conservative: -Average time from randomization to complete dilation was 412 minutes. -48% dystocia rate in those with >3cm dilation. -30% dystocia rate in those <3cm. -41% needed oxytocin. **Conclusion:** -Amniotomy more effective >3cm. -Cesarean section rates did not differ. -Newborn outcomes did not differ. -Cesarean section rates for fetal distress more frequent in amniotomy group.	**Strengths:** -Large sample size. -Not many other variables in study group. -Grouped specifically into <3cm or >3cm. -Complete randomization. **Limitations:** -Variables such as age, ethnicity, pregnancy complications were not identified.

Author Recommendations: Routine amniotomy before 3cm dilation has no benefit in nulliparous women. Amniotomy reduces the duration of labor and the frequency of dystocia in those dilated to 3 or more cm. Further assessment is needed in reductions in frequency of oxytocin use and newborn outcomes.

Summary for current clinical practice question:
In nulliparous women, amniotomy is appropriate to decrease labor duration and lessen the chances of dystocia only if the patient is 3cm or more in dilation.

Source: Ghafarzadeh, M., Moeininasab, S., & Namdari, M. (2015). Effect of early amniotomy on dystocia risk and cesarean delivery in nulliparous women: A randomized clinical trial. *Archives of Gynecology and Obstetrics*, *292*(2), 321-325. doi:10.1007/s00404-015-3645-x

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: Even as the most common obstetric procedure to accelerate labor, amniotomy continues to be controversial. The purpose of this study is to "determine the effect of early amniotomy on the risk of dystocia and cesarean delivery in nulliparous women" (p.321). **Sample/Setting:** Sample: 300 "Nulliparous women with singleton and term pregnancy (37-42 weeks gestational age), Blood pressure <140/90, spontaneous onset of labor, cephalic presentation of fetus, intact amniotic sac, and normal fetal heart rate" (p.322). Setting: Asali Hospital, Khoramabad, Iran, 2013. **Level of Evidence:** Level 1 (Experimental study, randomized controlled trial) **Quality:** High quality	Randomized Control Clinical Trial **Methods** Study participants were split in half. Each participant was randomly assigned to either the experimental group or the control group. Close attention was paid to age, weight, gestational age, fetal birth weight, and cervical effacement to make sure the two groups were as much similar as possible. Oxytocin was allowed in both groups. Experimental: 150 women were chosen for this group. Early amniotomy was performed at a cervical dilation of less than or equal to 4cm. Control: 150 women were chosen for this group. Amniotomy was not done unless there was an obstetric indication (such as dilation arrest for at least two hours, failure of labor progression, or fetal distress). **Instrument** The study does not particularly state the instrument used to measure the outcomes. However, medical chart were used to document results of the laboring patients.	**Conclusion:** The authors concluded that amniotomy significantly shortened the duration of labor in nulliparous women with no pregnancy complications. Dystocia, cesarean delivery, and placental abruption were significantly lower in the women who did receive the early amniotomy. Labor dystocia was decreased 80.6% and cesarean sections were decreased by 81.7% with the use of amniotomy.	**Strengths:** -Consistent results -Comprehensive review of other studies. -Adequate sample size. -Experimental and control groups were equal in size and pregnancy risk. -All ethical guidelines were followed. -Reproducible. -Outside factors were minimized by using a specific group of non-complicated pregnancies. **Limitations:** -This study was only done at one facility. -Demographics were not noted. -It is unknown how many of the control group had an amniotomy performed for "obstetric indications".

Author Recommendations:
Early amniotomy in nulliparous women is a safe method to decrease labor duration, cesarean rate, placental abruption, and dystocia.

Implications:
According to this study, amniotomy before 4cm is appropriate in nulliparous women to decrease the chances of labor dystocia and cesarean delivery. It is safe and effective to perform an amniotomy as an induction method, prior to the start of labor. According to this study, amniotomy is yet another form of induction that can be performed to aid in shortening labor in a woman who has started feeling contractions without cervical change.

Source: Gross M., Frömke C., & Hecker H. (2014). The timing of amniotomy, oxytocin and neuraxial analgesia and its association with labour duration and mode of birth. *Archives of Gynecology & Obstetrics, 289*(1):41-48. doi:10.1007/s00404-013-2916-7.

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: The purpose of this study was to study associations of different timings of intrapartum interventions with labor duration and mode of birth. **Sample/Setting:** Sample: 2,090 Nulliparous women and 1,873 multiparous women. Requirements: -Singleton, viable fetus. -Cephalic presentation. -At least 34 weeks gestation. -Planned vaginal birth Setting: 47 maternity units in the German state of Lower Saxony. April 2005 to October 2005. **Level of evidence:** Level 1 (Non-experimental) **Quality of evidence:** High quality	Longitudinal Cohort Study: 3,963 women on maternity units with interventions were studied. Labor: Defined as regular or irregular contractions, possibly accompanied by ruptured membranes. This was assessed and decided by the midwife. <u>Amniotomy:</u> Amniotomy was performed on 34.4% of nulliparous women and 41.8% of parous women. <u>Neuraxial analgesia:</u> Neuraxial analgesia was given in 34.8% of the nulliparous women and 12.4% of multiparous women. The median initiation time was 4.5 hours in nulliparous women and 3.2 hours in multiparous women. <u>Oxytocin augmentation:</u> -Oxytocin augmentation was performed on 52.4% of nulliparous women and 27% on multiparous women. -The median initiation time for oxytocin augmentation was six hours after the onset of labor for nulliparous women and four hours in multiparous women.	<u>Nulliparous</u> <u>Amniotomy:</u> -When compared to women with SROM, the first stage was accelerated when amniotomy was performed. However, a steady increase in hazards was observed in the first stage (earlier on in labor increased risk). <u>Oxytocin Augmentation:</u> The median time of labor from onset (with oxytocin) to birth was 3.2 hours. <u>Multiparous</u>: <u>Amniotomy:</u> -When compared to women with SROM, the first stage was accelerated when amniotomy was performed. Hazard ratio remained the same through all stages of labor. <u>Oxytocin Augmentation:</u> The median time of labor from onset (with oxytocin) to birth was 1.4 hours. **Conclusion:** -Amniotomy increases tendency for SVD. -Higher hazards may be seen in nulliparous women who get an amniotomy in the first stage of labor. -Early amniotomy results in earlier complete dilation in multiparous women.	**Strengths:** -Large sample size. -Well-balanced in factors that could cause variables. -Time-event analysis. **Limitations:** -Lack of cervical dilation data. -Lack of data on uterine contractions. -Lack of staging. - -No control group was noted. -Time-dependent interventions were studied, but not causal relationships.

Author Recommendations:
In the conclusion, the authors recommend that a randomized controlled trial is needed between measured amniotomies with other amniotomies with an early/late group.

Summary for current clinical practice question: This study revealed the shortening of labor times with performed amniotomies. Timing reveals there is no increased risk of performing early amniotomy in multiparous women in the first stage, but there is increased risks in nulliparous women with amniotomies in the first stage. Since this study is longitudinal and a time-event analysis, other labor factors were not clearly identified as benefiting or harming labor progression.

<table>
<tr><td colspan="4">Source: Herman, H. G., Tamayev, L., Houli, R., Miremberg, H., Bar, J., & Kovo, M. (2018). Risk factors for nonreassuring fetal heart rate tracings after artificial rupture of membranes in spontaneous labor. Birth, 45(4), 393-398. doi:10.1111/birt.12350</td></tr>
<tr><td>Purpose/Sample</td><td>Design (Method/Instruments)</td><td>Results</td><td>Strengths/Limitations</td></tr>
<tr>
<td>Purpose:
To characterize various factors associated with nonreassuring fetal heartones following an artificial rupture of membranes (AROM) in active labor.
Sample/Setting:
Using a retrospective cohort study of spontaneous deliveries meeting the following criteria:
-37-42 weeks gestation
-vertex presentation
-presented in active labor with intact membranes
-in their 1st to 3rd deliveries

Setting:
Edith Wolfson Medical Center in Tel Aviv, Israel.

Level of evidence:
Level III (retrospective cohort study)
Quality of evidence:
High Quality</td>
<td>Retrospective cohort study
Computerized files of all deliveries at Edith Wolfson Medical Center between 2015-2016 were reviewed with 664 deliveries matching the inclusion criteria. Out of those 664, 141 had non reassuring heart tones with 523 having normal fetal heartones.

Files were examined thoroughly to review differences in demographics, obstetrical history, pregnancy complications, and the course of labor. Nonreassuring FHR serves as the dependant variable with the independent variables studied were: epidural anesthesia, fetal station, cervical dilatation at time of AROM, use of oxytocin augmentation, time from AROM to delivery, and the infant’s birth weight.</td>
<td><u>Non Reassuring FHR group:</u>
-birthweight was significantly lower.
-A significantly higher rate of nonreassuring FHR with those using epidural anesthesia.
-rates of cesarean sections were significantly higher.
-higher rates of meconium
-The use of instrumental deliveries were drastically increased.
-significantly lower BISHOP scores at the time of AROM.
-length of time from AROM to delivery was significantly higher.
<u>Normal FHR Group:</u>
-significantly higher rate of nulliparous women
-Diabetes, hypertension, and smoking status had no statistical significance between the two groups.
-lower use of oxytocin (41.1%) compared to 70.2% in the nonreassuring group.
Conclusion:
The study demonstrated the association between nonreassuring fetal heart tones after AROM during active labor examining fetal station at time of AROM, oxytocin use during labor, and time of delivery.</td>
<td>Strengths:
-Showed the aspects of AROM and its effects on fetal heart tracing.
Large sample size which allowed researchers to differentiate between nulliparous vs multiparous

Limitations:
-retrospective in nature
-the definition of nonreassuring heartones varies based on the sole interpretation by the delivering provider.
-patients underwent amniotomy under different stages of cervical change.
-just used data from one medical facility</td>
</tr>
<tr><td colspan="4">Author Recommendations:
They propose a prospective and randomized setting with a control group of patient who did not undergo AROM. This will further expand our knowledge and understanding of the effect that AROM plays in active labor process.</td></tr>
<tr><td colspan="4">Summary for current clinical practice question:
Nonreassuring fetal heart tones after artificial rupture of membranes is highly associated with parity, fetal station at time of AROM, infant birth weight, and oxytocin use.</td></tr>
</table>

<table>
<tr><td colspan="4">Source: Kuper, S., Jauk, V., Baalbaki, S., Tita, A., Harper, L., & Parrish, M. (2017). Does Early Artificial Rupture of Membranes Speed Labor in Preterm Inductions? American Journal of Perinatology, 35(08), 716-720. doi:10.1055/s-0037-1612631</td></tr>
<tr><td>Purpose/Sample</td><td>Design (Method/Instruments)</td><td>Results</td><td>Strengths/Limitations</td></tr>
<tr><td>Purpose:
To better understand the impact that AROM plays on preterm patients undergoing a medically indicated induction of labor.

Sample/Setting:
149 preeclamptic pregnant women between 23-34 weeks gestation requiring medical induction of labor.

Setting: A Single tertiary care center from 2011-2014

Level of evidence:
Level III

Quality of evidence:
Good</td><td>Retrospective Cohort Study

23-34 week patients requiring a medical induction of labor. 149 patients included 65 had early amniotomy and 84 were studied in the late amniotomy. Early amniotomy was defined at less than 4cm. The two primary outcomes were length of labor and cesarean section rate. Looked at the two groups to see the difference between these outcomes.
Instruments:
Electronic medical record to find records. Student's t-test for descriptive and univariable statistics. Chi-squared was used for categorical variables.</td><td>Early Amniotomy
-25.7 hours average time to delivery

Late Amniotomy
-19 hours average time to delivery
-lower cesarean section rate

Conclusion:
Early amniotomy is associated with a higher risk of cesarean section but not with a shorter labor or negative maternal or fetal outcomes. Was not effective at stimulating labor</td><td>Strengths:

-Detailed patient level data that was collected.
-All patients managed according to the same policy and protocol.

Limitations:
-Possible confounding by indication
- small sample size
-hard to replicate</td></tr>
<tr><td colspan="4">Author Recommendations: A randomized controlled trial is needed.</td></tr>
<tr><td colspan="4">Summary for current clinical practice question:
Preterm patients act differently with AROM then term patients and length of labor is significantly longer when performed early amniotomy with no difference in chorioamnionitis. Cesarean section was noticeably higher.</td></tr>
</table>

Source: Macones G., Cahill A., Stamilio D., & Odibo A. (2012). The efficacy of early amniotomy in nulliparous labor induction: a randomized controlled trial. *American Journal of Obstetrics & Gynecology 207*(5):403.e1-5. doi:10.1016/j.ajog.2012.08.032.

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: The purpose of this study was to assess whether early amniotomy reduces the length of labor. **Sample/Setting:** Sample included 585 women Sample Inclusion: ->37 weeks gestation -Need for labor induction as determined by physician -Nulliparity -Singleton fetus -<4cm dilation Setting: **Level of evidence:** Level 1 (Experimental study) **Quality of evidence:** High Quality	Non-blinded randomized clinical trial. Patients were randomly assigned to either the early amniotomy group or to standard management. <u>Early amniotomy:</u> -Defined as AROM before or at 4cm dilation. -Were performed as early as the provider deemed it safe. -292 women assigned to early amniotomy. <u>Standard management:</u> -Defined as amniotomy at dilation of greater than 4cm. -293 women assigned to standard management.	<u>Early amniotomy:</u> -Average time from start of induction to delivery was shortened by almost 2 hours. -68% of women were delivered within 24 hours. -11.5% of women got chorioamnionitis. <u>Standard management:</u> -56% of women were delivered within 24 hours. -8.5% of women got chorioamnionitis. There was no significant difference in the need for a cesarean section between the two groups. **Conclusion:** This study concludes that early amniotomy may shorten labor time by about 2 hours and does not impact the rate of cesarean delivery.	**Strengths:** -Subjects were randomly assigned. -Both study groups were well-balanced in regards to other factors (such as medical conditions, demographics, gestational age). -Large study size. **Limitations:** -Not a blinded study.

Author Recommendations:
The author recommends the results of this study need to be weighed with the maternal and neonatal concerns. Although there was no statistically significant difference in the rate of chorioamnionitis, there was an increase in the early amniotomy group.

Summary for current clinical practice question:
Early amniotomy may be effective as a tool to shorten labor for inductions.

Source: Makarem M., Zahran K., Abdellah M., & Karen M. (2013). Early amniotomy after vaginal misoprostol for induction of labor: a randomized clinical trial. *Archives of Gynecology & Obstetrics 288*(2):261-265. doi:10.1007/s00404-013-2747-6.

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: The purpose of this study is to test the effectiveness and safety of early amniotomy after Cytotec, for induction of labor. **Sample/Setting:** Sample: 320 pregnant women. Inclusion criteria: -Medical or obstetric indication for labor. -36 weeks or more gestation. -Singleton living fetus. -Cephalic presentation. -AFI >5cm. -Reactive NST. -Negative CST. Setting: This trial took place at the Women's Health Center at Assiut University from September 2008 to December 2010. **Level of evidence:** Level 1 (Experimental study) **Quality of evidence:** High Quality	Randomized Clinical Study 320 women who attended the antenatal care clinic and met the requirements for the trial were randomly assigned by a computer generated randomization to have either early or late amniotomy. Misoprostol 50 mcg. was given q6 hours. Early: Was done in the early active phase of labor. Cervix was 3 cm and fetal head had to be applied to cervix. Late: Amniotomy was not done until the membranes ruptured on their own. Instruments: Amnihook was used for all amniotomies.	Early amniotomy: -Labor duration of 9.72 hours. -Duration of ROM was 3.28 hours. -Neonatal outcomes were better. -lower rates of meconium, low APGARs, need for NRP, and NICU admissions (not statistically significant.) No amniotomy: -Labor duration of 13.61 hours. -Duration of ROM was 2.22 hours. **Conclusion:** -In this trial, shorter labors were seen in the early amniotomy group and there was no statistical significant difference in neonatal outcomes. -More women in the early amniotomy group were found to have a vaginal delivery before 24 hours. -Cesarean section was higher in the control group than the amniotomy group (not statistically significant)	**Strengths:** -Controlled study. -Other variables were equal on both the control group and the amniotomy group. **Limitations:** -Not a blinded study. -Small study size.

Author Recommendations:
The authors conclude that early intervention with AROM after Cytotec (and early active labor) is appropriate to shorten labor with no associated increased risk.

Summary for current clinical practice question:
According to this trial, amniotomy is an appropriate intervention to aid in shortening labor duration, without any associated risks. There was no increased risk of fever, meconium stained fluid, tachysystole, nausea/vomiting, low APGAR scores, need for resuscitation or hyperstimulation.

<table>
<tr><td colspan="4">Source: Mei-Dan, E., Asztalos, A., Willan, A., Barrett, J. (2017). The effect of induction method in twin pregnancies: a secondary analysis for the twin birth study. BMC Pregnancy Childbirth, 17(9). doi:10.1186/s12884-016-1201-8</td></tr>
<tr><td>Purpose/Sample</td><td>Design (Method/Instruments)</td><td>Results</td><td>Strengths/Limitations</td></tr>
<tr><td>Purpose:
This studies purpose is to compare cesarean rates and overall safety between different methods of inductions in twin pregnancies.

Sample/Setting:
Sample:
The vaginal delivery group included 1,406 women.
-368 of these were induced
-153 were induced by prostaglandin.
-215 were induced by amniotomy and/or oxytocin

Inclusion criteria:
-Between 32-38 weeks gestation.
-First twin was in cephalic presentation.
-Both twins viable fetuses.
-EFW between 1500g-4000g.

Setting:
The information in this study was taken from the Center for Mother, Infant, and Child Research at the Sunnybrook Health Sciences Center in Toronto, Canada.

Level of evidence:
Level 1 (Randomized Control Trial)
Quality of evidence:
High Quality</td><td>-Data for this study was collected from medical records by trained study staff.
-An experienced physician with twin vaginal deliveries was required for all study cases.
-Induction methods were chosen by provider caring for the patients.
-Study subjects were placed in either the prostaglandin group or the no prostaglandin group (amniotomy/oxytocin).

Instruments:
-Durations were investigated using two-sample t-tests.</td><td>-149 inductions underwent a cesarean section, in the end.
-Nulliparous women were less likely to have a successful vaginal delivery than multiparous.

Prostaglandin:
-Did not increase risk of cesarean section.
-40.5% cesarean section rate in PG group.

Amniotomy/Oxytocin group:
-40.5% cesarean section rate.
Conclusion:
The rate of cesarean section is not increased by either the use prostaglandin or amniotomy/oxytocin use with twin induction.
-Author mentions that both prostaglandin and other forms of induction for twins yielded a high cesarean section rate.</td><td>Strengths:
-Large sample size.

Limitations:
-Study did not single out each induction method.</td></tr>
<tr><td colspan="4">Author Recommendations:
Further studies are needed to determine the effectiveness and safety of various induction methods in twin pregnancies.</td></tr>
<tr><td colspan="4">Summary for current clinical practice question:
There was no difference in the rate of cesarean section in women with amniotomy, in this study. However, it was never singled out as an induction method.</td></tr>
</table>

Source: Nachum, Z., Garmi, G., Kadan, Y., Zafran, N., Shalev, E., & Salim, R. (2010). Comparison between amniotomy, oxytocin or both for augmentation of labor in prolonged latent phase: a randomized controlled trial. *Reproductive biology and endocrinology*, *8*(1), 136. Link: https://rbej.biomedcentral.com/articles/10.1186/1477-7827-8-136

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: The purpose of this study was to compare amniotomy, oxytocin, or both in the use for augmentation of labor in prolonged latent stages of labor **Sample/Setting:** Sample: 213 hospitalized women were chosen for this study. Inclusion criteria: -cephalic presentation -prolonged latent stage of labor -singleton, term fetus -spontaneous onset of labor -no more than 2 and 4 cm above pelvic inlet. Setting: Subjects were studied between January 2006 and January 2009, at Ha'Emek Medical Center in Afula, Israel. **Level of evidence:** Level 1 (Experimental study, randomized controlled trial) **Quality of evidence:** High quality	Randomized Control Study: 213 women, who met the criteria, were studied with or without interventions. They were randomly assigned to one of the following groups: amniotomy, oxytocin, both, or the control. Women placed in the control group were those who spontaneously continued to progress in labor. Amniotomy: Amniotomy was performed immediately upon admission to the labor unit. In the event that inadequate contractions were noted after one hour of amniotomy, oxytocin was started. Oxytocin: The use of oxytocin was initiated immediately after admission to the labor unit. Amniotomy/Oxytocin: This group had women who were started on oxytocin and an amniotomy was performed immediately upon admission to the labor unit. *Instrument*: The latent stage of labor was measured in hours from the start of regular contractions (according to the mother) until active phase of labor was begun at greater than 4cm.	Primiparous: Statistically shorter labor in the amniotomy/oxytocin group than in any of the other groups, and also had less vaginal examinations performed. Women with no interventions (spontaneous labor continuation) were overall more satisfied. Multiparous: Statistically significant difference between women with amniotomy/oxytocin and those with just oxytocin or the control. No significant difference between those with amniotomy/oxytocin and amniotomy alone. **Conclusion:** The combination of oxytocin and amniotomy are most effective in women who have a prolonged latent phase of labor.	**Strengths:** -Consistent results -Adequate control group -Definitive conclusions -Consistent recommendations -Literature review comprehensive -Large sample size **Limitations:** -Some of the amniotomy group were given oxytocin when labor was not progressed with amniotomy alone after only 1 hour. To make the results more accurate, more time should have been given to the amniotomy group.

Author Recommendations:
In the conclusion, the authors recommend the use of both oxytocin and amniotomy in the treatment of prolonged latent labor.

Summary for current clinical practice question: This study revealed that although amniotomy increased the chances of fever and intrapartum antibiotics, it may significantly reduce the time of labor in both primiparous and multiparous women. This study could have been more controlled, as the length of the latent phase was based on the woman's perception of when "regular contractions started".

Source: Neal, J., Lamp, J. M., Buck, J. S., Lowe, N. L., Gillespie, S. L., & Ryan, S. L. (2014). Outcomes of Nulliparous Women with Spontaneous Labor Onset Admitted to Hospitals in Preactive versus Active Labor. *Journal of Midwifery & Womens Health, 59*(1), 28-34. doi:10.1111/jmwh.12244			
Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To estimate the low-risk percentage of term nulliparous women admitted to the hospital prior to the onset of labor and to further evaluate the cascading effects on the timing of admission, labor based interventions, and delivery type. **Sample/Setting:** 216 low-risk nulliparous women (ages 18-39) with no pregnancy complications and dilated between 1-6cm upon admission to the hospital. Additional criteria for the sample included: 37-42 weeks gestation, singleton, cephalic presentation, no known fetal anomalies or growth restrictions and all participants were able to read and write professionally in English. Setting: 3 large Midwestern hospitals **Level of evidence:** Level III Quality of evidence: High	*Qualitative* Two prospective research studies from 07-08 and 2011-12. Women were approached once on the labor and delivery unit. Based on their first cervical dilatation and their cervical change (or lack thereof) at 4 hours post admission using a priori criteria. **Instruments:** Groups were then divided into preactive and active using Fisher's exact tests for binary variables Mann-Whitney U tests for continuous level data. Logistic regression was used to assess the labor care pattern (ie, oxytocin augmentation, amniotomy).	Preactive -less effaced at admission -significantly higher BMI -7h ROM to Birth time -84.2% required IV oxytocin augmentation -12.3% developed fevers in the time between amniotomy (ROM) and delivery. -4 hour longer labor than the active group -significantly higher rate of cesarean section. -great number of cervical exams during labor Active -4.6h ROM to Birth time -46% required IV oxytocin augmentation -4.9% developed fevers between ROM and delivery. -No arrest of descent cesareans **Conclusion:** No significant cervical difference at time of admission between the two groups but by the four hour mark there was a vast difference. Cervical effacement was a better indicator to active vs preactive than dilatation. Amniotomy rates between the two groups were similar.	**Strengths:** -the labor admission criteria did not change between the 3 years of the study. - Reconfirmed that many cesareans performed on nulliparous woman are performed before active labor even begins. **Limitations:** -limited data from 2 prospective studies performed 3 years apart. -confounding factors that affects and impacts labor outcomes (ie, provider practice routines, support of staff during labor).

Author Recommendations: Standardization of labor admission decision for low-risk nulliparous women with spontaneous labor onset and further that clinicians should be careful to not misdiagnosis primary dystocia when in reality it is preactive labor. A large randomized trial in a more diverse setting would be useful to determine the effects of how the timing of admission contributes to labor intervention like amniotomy and mode of delivery.
Summary for current clinical practice question: Clinicians should be cautious admitting a patient prior to 4cm as the risk for cesarean section for those admitted prior to 4cm is increased. Women requesting admission or elective induction should be well informed that they will most likely receive oxytocin and be at a much greater risk of delivering via cesarean.

Source: Onah, L. N., Dim, C. C., Nwagha, U. I., & Ozumba, B. C. (2015). Effect of early amniotomy on the outcome of spontaneous labour: a randomized controlled trial of pregnant women in Enugu, South-east Nigeria. *African health sciences*, *15*(4), 1097-103.

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To determine the effects that early AROM has on the duration of labor and other outcomes for both mother and child. **Sample/Setting:** 214 singleton and term women in spontaneous active labor with intact fetal membranes. Setting: Nigeria Teaching Hospital in Enugu, Nigeria **Level of evidence:** Level 1 **Quality of evidence:** High	Randomized Controlled Trial -Screening was done at the antenatal clinic during pregnancy. During this counseling, the women were given an envelope with a number inside. Upon admission, they were to give this number to the researcher at the hospital and then she signed the written consent. The 214 women were divided into two different groups. The control group that received no amniotomy and the amniotomy group that had membranes ruptured at 4-5cm followed by oxytocin. Exclusions criteria- abnormal presentation, cervical dilation of 6cm or greater, previous C-section, cord presentation, and complicating medical conditions (ie, diabetes, HTN, HIV). **Instruments:** An Independent statistician using a computer generated random number sequence and then placed random number sequences into consecutively number opaque and sealed envelopes.	Both groups had intermittent auscultation every 15 minutes. No clinical difference in APGAR scores. <u>Control Group-</u> -No amniotomy -More oxytocin needed -if progress was not being made, amniotomy was still performed <u>Intervention Group</u> -Amniotomy performed at 4-5cm -oxytocin started immediately after AROM -shorter labor duration by 74 minutes **Conclusion:** Early amniotomy reduced the duration of labor compared to the control group. 3 women in the intervention group needed oxytocin compared to 21 in the control.	**Strengths:** -Strong randomization -Consent discuss month prior to study **Limitations:** Hard to replicate outside of Nigeria Small Sample size Restriction of the study to only those low risk pregnant women Contamination risk

Author Recommendations: Early amniotomy in low risk term patient is a good way that is cost effective to quickly progress labor and reduce time in active labor.

Summary for current clinical practice question:
Early amniotomy is associated with shorter time in active labor and less need for oxytocin.

Source: Pasko, D., Jauk, V., & Subramaniam, A. (2018). Pregnancy Outcomes after Early Amniotomy among Class III Obese Gravidas Undergoing Induction of Labor. *American Journal of Perinatology*. doi:10.1055/s-0038-1675331

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To evaluate the various pregnancy outcomes in women with class III obesity receiving an early amniotomy during an induction of labor. **Sample/Setting:** Sample: 285 class III obese patients with a BMI over 40kg/m undergoing induction of labor between 37-41 weeks gestation. Setting: Data obtained from REDCap Consortium, Vanderbilt University Nashville, TN. **Level of evidence:** Level III Retrospective cohort study **Quality of evidence:** High quality	Retrospective cohort study: Women with singleton gestations, a BMI greater than 40, and who underwent a scheduled induction of labor were identified by researchers using validated obstetric research databases. Various exclusion criteria existed including: spontaneous labor, multifetal gestation, fetal demise, immunodeficiency, and prenatal congenital anomalies. 285 women met the criteria with 107 (37.5%) has an elective amniotomy and 178 (62.5%) underwent late amniotomy.	Early Amniotomy: -Less than 4cm dilated among nulliparous women: -increased cesarean risk - Significantly increased time from ROM to delivery. -overall longer length of labor -50.5% overall cesarean rate Late Amniotomy: -greater than 4cm -30.3% overall cesarean rate -lower cesarean rate **Conclusion:** Early amniotomy is associated with adverse outcomes in obese women requiring an induction of labor.	**Strengths:** -Consistent results -Adequate control group -Definitive conclusions -Consistent recommendations -Literature review comprehensive -stratified the analysis by parity based on known differences between nulliparous and multiparous women. **Limitations:** -The analysis was not able to account for potential confounding by indication. -sample size limited the power to detect significant differences in secondary outcomes. -Because the study spanned 6 years, the guidelines listed in the Consortium on Safe Labor may not be applicable to the findings.

Author Recommendations: Further spective research and evaluation is needed to determine if these results can be replicated but healthcare professionals should be mindful of this information when inducing an obese patient.

Summary for current clinical practice question: the findings within this study highlight a potential link between early amniotomy and various adverse negative outcomes among class III obese women who require an induction of labor.

<table>
<tr><td colspan="4">Source: Petersen, A., Poetter, U., Michelsen, C., & Gross, M. M. (2013). The sequence of intrapartum interventions: a descriptive approach to the cascade of interventions. Archives of gynecology and obstetrics, 288(2), 245-254. doi: 10.1007/s00404-013-2737-8.</td></tr>
<tr><td>Purpose/Sample</td><td>Design (Method/Instruments)</td><td>Results</td><td>Strengths/Limitations</td></tr>
<tr><td>Purpose:
-The purpose of this study was to model the timing and sequence of labor interventions and estimate the association with labor length and delivery mode.
Sample/Setting:
Sample:
-The study included 2,082 nulliparous women and 1,873 multiparous women, with at least one intervention.
-1,313 experienced a normal labor without any interventions.
Requirements for study:
-Low-risk pregnancy.
-Single, viable fetus.
-Vaginal birth.
-34+ weeks gestation.
Setting: 47 maternity units in Lower Saxony, Germany.
Level of evidence:
Level 1 (Non-experimental)
Quality of evidence:
High</td><td>Method:
-Women meeting the requirements of the study were induced by oxytocin, prostaglandins, amniotomy, misoprostol, or castor oil.
-Most cases included several interventions.
-Amniotomy, oxytocin augmentation, and epidural analgesia was modeled in sequence.
-Log rank test was used to determine differences in cervical dilation.</td><td>Oxytocin:
-Most frequent intervention in nulliparous.
-Most frequently delivered between 2-4cm.
Amniotomy:
-Most frequent intervention in multiparous.
-80% of multiparous women experienced spontaneous labor after amniotomy.
-most frequently done around 7cm.
-Most did not need further interventions

Epidural Analgesia:
-Was not the first intervention in most multiparous women.
Number of spontaneous births decreased with increased number of interventions.
Conclusion:
Amniotomies are effective at progressing labor, lessening the need for further labor interventions.</td><td>Strengths:
-Large sample size.

Limitations:
-All women in study were low risk.
-Was not fully representative as only women from one location were studied.</td></tr>
<tr><td colspan="4">Author Recommendations:
No recommendations were noted.</td></tr>
<tr><td colspan="4">Summary for current clinical practice question:
Amniotomy may be effective in preventing the use of further labor interventions.</td></tr>
</table>

Source: Rota, A., Antolini, L., Colciago, E., Nespoli, A., Borrelli, S., & Fumagalli, S. (2018). Timing of hospital admission in labour: Latent versus active phase, mode of birth and intrapartum interventions. A correlational study. *Women and Birth, 31*(4), 313-318. doi:10.1016/j.wombi.2017.10.001

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: To determine and assess the association between hospital admissions (latent vs. active phases of labor), mode of birth, and interventions performed throughout. **Sample/Setting:** 1,446 records from low risk women who gave birth at this hospital. Setting: A large Italian maternity center **Level of evidence:** Level 1 **Quality of evidence:** High	Correlational Study Using electronic medical records review, the researchers found women giving birth between 37-42 weeks with a singleton pregnancy, cephalic, and between the ages of 18-45 Exclusion criteria was: history of cesarean, preeclampsia, chronic hypertension, and preadmission rupture of membranes.	<u>Active Labor</u> -23.2% AROM -52.7% of participants - lower rate of epidural analgesia (6.7%) <u>Latent labor</u> -37.7% AROM rate -higher rate of oxytocin augmentation -increased risk for cesarean delivery -increased risk for instrumental delivery. -higher rate of episiotomy -high rate of epidural (22.4) **Conclusion:** The findings contribute to raise further awareness to healthcare providers and patients about the admission, managements, and treatment in early labor compared to active labor and the rates of interventions performed with women who are in latent labor.	**Strengths:** -reinforces the midwifery model of care. -further proves the "cascade effect" of labor interventions for latent labor admission **Limitations:** -Setting is not representative of all Obstetrical units as this area views childbirth as a normal event which is different in most other places. -Small sample size

Author Recommendations: Since it has been determined that admission prior to active labor correlates with higher probability of intrapartum interventions. Early labor assessments and triage should be enable in facilities and that adequate education is provided to women in latent labor and the benefits of waiting for active labor.

Summary for current clinical practice question:
Admission to labor and delivery unit should wait until after active labor has begun unless medically indicated. Rate of intrapartum interventions (including AROM) is much higher.

Source: Selo-Ojeme, D.O., Pisal, P., Lawal, O., Rogers, C., Shah, A., Sinha, S. (2008). A randomized controlled trial of amniotomy and immediate oxytocin infusion versus amniotomy and delayed oxytocin infusion for induction of labour at term. Archives of Gynecology and Obstetrics, 279. Doi:10.1007/s00404-008-0818-x.

Purpose/Sample	**Design (Method/Instruments)**	**Results**	**Strengths/Limitations**
Purpose: The purpose of this study is to compare the efficacy of amniotomy and immediate oxytocin infusion with amniotomy and delayed oxytocin infusion for induction. **Sample/Setting:** **Sample:** -123 women -Planned induction of labor -nulliparity -singleton term pregnancy -cephalic presentation -intact membranes -no regular contractions -favorable cervix (Bishop's score >6) -No uterine surgery -Uncomplicated pregnancy **Setting:** -Women were recruited through an antenatal clinic from December 2006 to September 2007. **Johns Hopkins Evidence Appraisal:** Level 1 (Experimental) **Strength:** **Quality:** High quality	Randomized controlled trial **Method:** Women included in the study were either placed in the immediate group or the delayed group at random. All subjects were examined 4 hours after amniotomy and as needed based on clinical judgment of the midwife. <u>Immediate:</u> 61 women were assigned to immediate group. Oxytocin infusion was started immediately post-amniotomy. <u>Delayed:</u> 62 women were assigned to the delayed group. Oxytocin infusion was started 4 hours after amniotomy.	<u>Immediate:</u> -70.1% of women were in labor by the 4 hour examination. -100% of these women had oxytocin infusion. -77.1% of these women had a SVD within 12 hours. <u>Delayed:</u> -44.1% were in labor by the 4 hour examination. -80.6% of these women had oxytocin infusion. -58.1% of these women had SVD within 12 hours. **Conclusion:** This study concludes that the initiated of oxytocin immediately after amniotomy may shorten labor times, but does not affect the rate of cesarean section or operative deliveries.	**Strengths:** -Completely randomized trial. -Controlled variables. **Limitations:** -Ethnicity was not included in comparability of two categories. -Neither the midwife, nor the patients were blind to the treatment group.

Author Recommendations:
The author recommends further studies on this subject before creating a practice based on its results. They recommend a larger sample size, with a blinded study.

Implications:
When added to amniotomy, immediate oxytocin may decrease labor time by shortening the time to active labor. However, this shows no effect on mode of delivery, PPH, or other labor risks.

<table>
<tr><td colspan="4">Source: Tam, T., Conte, M., Schuler, H., Malang, S., & Roque, M. (2013). Delivery outcomes in women undergoing elective labor induction at term. Archives of gynecology and obstetrics, 287(3), 407-411. doi:10.1007/s00404-012-2582-1</td></tr>
<tr><td>Purpose/Sample</td><td>Design (Method/Instruments)</td><td>Results</td><td>Strengths/Limitations</td></tr>
<tr><td>Purpose:
The purpose of this study was to determine elective induction outcomes in term, low-risk women.

Sample/Setting:
Sample:
-848 low risk patients.
-Patients had to have a prior cervical exam.
-Women were >39 weeks and <41 weeks.
-Singleton pregnancies only.
-Vertex presentation.

Setting:
-Resurrection Health Care/Saint Joseph hospital.
-This study was set in a community teaching hospital from Jan 1, 2006- Jan 31, 2010.

Level of evidence: Level 1

Quality of evidence: High</td><td>Retrospective Cohort Study

-848 records were reviewed of patients who underwent an elective induction.
-The time was calculated from the start of induction method until delivery.
-Outcome measures were delivery method and cesarean indications.
-Women with medical/pregnancy/ any complications were excluded from this study.

Instruments:
-Statistics, frequencies, and percentages were reported using multiple regression analysis, analysis of variance, andeffect tests with respective values reported.</td><td>Oxytocin:
-The majority of patients had oxytocin as the primary induction agent.
-Average length of induction is 11.9hours.
-Use of oxytocin in nulliparous women with unfavorable cervix resulted in a higher amount of operative deliveries.

Amniotomy:
-Statistically significant shorter length of induction.
-Average length of labor 8.66 Hours.

Conclusion:
Both induction by oxytocin and amniotomy aid in shorter induction times.</td><td>Strengths:
-Large study size.

Limitations:
-Induction methods were not singled out.
-Other unbeneficial outcomes were not studied in this.</td></tr>
<tr><td colspan="4">Author Recommendations:
These findings should be further analyzes to improve current guidelines for elective inductions. The author recommends that a favorable cervical exam also be included in decision making for an elective induction, along with the requirement of 39 weeks gestation.</td></tr>
<tr><td colspan="4">Summary for current clinical practice question:
This study reveals a shorter induction with women who underwent amniotomy. The induction time was shortened by about 2 hours.</td></tr>
</table>