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THE EFFECT OF THE TIME OF INJECTION OF INTRATHECAL ANALGESIA
ON THE LENGTH OF EARLY AND ADVANCED LABOR

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ABSTRACT

Controversies in obstetric anesthesia include the effect of regional analgesia on the progress and length of labor. The purpose of this retrospective study was to determine the effect of the timing of intrathecal narcotic analgesia on women in the labor and delivery setting. The study population included 96 patients with low risk, singleton pregnancies with similar demographic characteristics. The study measured the length of first stage, second stage and total length of labor for women who received their initial intrathecal narcotic injection either in early (between two and four centimeters of cervical dilation) or advanced (between five and ten centimeters of cervical dilation) labor. The results were compared to a control group who received no regional anesthesia to determine if the timing of the initial intrathecal injection increased, decreased or had no effect on length of labor. This study found that the initial timing of intrathecal narcotics had no effect on the length of the first stage of labor. The results showed that the length of the second stage of labor for patients who received intrathecal narcotics in advanced labor increased from 25 minutes to 49 minutes compared to women who received no regional anesthesia. The timing of the first dose of the intrathecal narcotic had no effect on the total length of labor. The results of this study found that intrathecal narcotics do not prolong the length of labor.

Key Words: intrathecal anesthesia, intrathecal narcotics, labor analgesia, regional anesthesia, spinal anesthesia, progress of labor

THE EFFECT OF THE TIME OF INJECTION OF INTRATHECAL ANALGESIA
ON THE LENGTH OF EARLY AND ADVANCED LABOR

by

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vi

PREFACE

This research was conducted to determine the effect of the timing of intrathecal narcotic analgesia on women in the labor and delivery setting. The purpose was to reveal intrathecal narcotic administration as less time consuming for the anesthesia provider and can be safely used as an anesthetic technique for labor and delivery to provide pain relief without altering the progress of labor. It was designed to support the use of intrathecal narcotics in smaller Air Force medical facilities with limited anesthesia support.

DEDICATION AND ACKNOWLEDGMENT

I dedicate this thesis to my parents, Dan and Sharon Koiro. Without their constant love, encouragement and support, this paper and the completion of my degree would not have been possible. The past two years have been the most difficult of my life and they have been there every day to listen to me cry or energetically tell them about my day. I would also like to acknowledge my committee members, Dr. E. Jane McCarthy, Dr. Eugene Levine and LtCol Judy Ikirt for their guidance and support throughout this project.

TABLE OF CONTENTS

PREFACE/FORWARD.....	vii
DEDICATION AND ACKNOWLEDGEMENTS.....	viii
LIST OF TABLES.....	xii
LIST OF FIGURES.....	xiii
CHAPTER I: INTRODUCTION	
Background of the Problem.....	1
Rationale and Significance of the Problem.....	2
Statement of the Problem.....	3
Null Hypotheses.....	4
Dependent Variables.....	5
Conceptual Framework.....	5
Conceptual Definitions.....	7
Operational Definitions.....	9
Assumptions.....	10
Limitations.....	10
Summary.....	10
CHAPTER II: REVIEW OF LITERATURE	
Review of the Literature.....	12
Summary.....	18
CHAPTER III: METHODOLOGY	
Introduction.....	19

Sample.....	19
Instrumentation.....	19
Research Design.....	20
Statistical Analysis.....	21
Protection of Human Subjects.....	22
CHAPTER IV: RESULTS	
Introduction.....	23
Characteristics of the Study Sample.....	23
Dilation at Time of Injection.....	25
Calculation of Mean Length of Each Stage of Labor.....	25
The Length of the Stages of Labor for Primipara and Multipara Women.....	27
Intrathecal Narcotics and the Use of Oxytocin.....	29
CHAPTER V: DISCUSSION	
Introduction.....	31
Study Demographics.....	31
The Effect of Intrathecal Narcotics on Length of Labor.....	32
The Effect of Parity on the Length of Labor.....	34
The Effect of Intrathecal Narcotics on the Use of Oxytocin.....	34
Study Limitations.....	35
Future Studies.....	36
Summary.....	36
REFERENCES.....	37

APPENDIX: SPSS Database Spreadsheet

LIST OF TABLES

Table 1. Mean Values of Various Components of Labor.....	7
Table 2. Characteristics of the Study Sample.....	24
Table 3. Race of the Study Sample.....	24
Table 4. Cervical Dilation at Time of Intrathecal Narcotic Injection.....	25
Table 5. The Length of Labor by Analgesia.....	26
Table 6. The Length of Labor by Analgesia and Parity.....	28
Table 7. Oxytocin Administration for Intrathecal and No Regional Groups.....	30

LIST OF FIGURES

Figure 1. Mean Length in Minutes of Each Stage of Labor.....	27
Figure 2. The Length of First Stage Labor for Primiparas and Multiparas.....	28
Figure 3. The Length of Second Stage Labor for Primiparas and Multiparas.....	29
Figure 4. The Length of the Total Length of Labor for Primiparas and Multiparas.....	29

CHAPTER I: INTRODUCTION

Background of the Problem

The choice of an obstetric anesthetic and its influence on the progress and management of labor are inextricably bound together. Many studies have been conducted to provide a greater understanding of the effects of drugs on the fetus and on the progress of labor (Abboud et al., 1984; Herpolsheimer & Schretenthaler, 1994). However, because of the variability intrinsic in human labor and the difficulty in obtaining objectivity, divergence of claims pertaining to the action of drugs on the course of labor appears throughout the medical literature (Friedman, 1965).

The ideal obstetric analgesic is defined as one that provides pain relief for the parturient while avoiding fetal depression and adverse effects on the progress of labor (James, Wheeler, & Dewan, 1988). Additionally, maternal analgesia should be free from toxic side effects and predictable in onset time, analgesic potency, and duration of action. Until such a perfect analgesic becomes evident, the known effects of existing techniques on mother, fetus, and neonate govern the choice of analgesia or anesthesia in the labor and delivery setting.

Regional anesthesia for obstetrics was discovered with the injection of cocaine intraspinally in the early 1900s by Oskar Kries in Basel, Switzerland (Stampone, 1990). In the early 1940s, continuous caudal and lumbar anesthesia was used to alleviate the pain of labor and delivery. The continuous epidural block came of age in the 1960s and 1970s and remains one of the most popular forms of pain relief in obstetrical suites today (Manning, 1996). One of the more controversial aspects of regional anesthesia for

obstetrics is the question of whether these techniques influence the length and pattern of labor, the incidence of malposition, the use of forceps, and the rate of cesarean delivery (Gribble & Meier, 1991). Ideally, analgesia for labor should relieve pain while maintaining maternal expulsive forces of labor and motor tone. Lumbar epidural analgesia frequently fails to meet this criterion because as many as half of the women receiving lumbar epidural analgesia have at least partial motor block at the time of delivery. Intrathecal narcotics however, act on spinal opiate receptors without affecting motor neurons so that the patient's motor function is unimpaired (Leighton, Desimone, Norris, & Ben-David, 1989).

Rationale and Significance of the Problem

The majority of obstetricians agree the initiation of epidural analgesia during the latent phase of labor is more likely to delay its progress (Gabbe, Niebyl, & Simpson, 1996). The problem with delaying epidural analgesia until the onset of the active phase of labor is that it is often difficult to determine this phase prospectively. Approximately 50 percent of patients will enter the active phase by four centimeters cervical dilation, while the remaining women will not enter active phase until more than five centimeters cervical dilation. If the initiation of epidural analgesia is delayed until the patient reaches an arbitrary dilation, some patients are subjected to unnecessary periods of severe pain. On the other hand, earlier initiation of epidural analgesia may slow labor in some parturients.

Initially, intrathecal narcotics were used for chronic and postoperative pain management in 1979 (Wang, Nauss & Thomas, 1979). Their use for relieving pain during labor began in 1980 with intrathecal morphine (Baraka, Noueihid, & Hajj, 1981).

Two observations were made during this time: A woman could feel her contractions but not the pain associated with them and sufficient pain relief was not obtained for the actual delivery. However, intrathecal narcotics used in association with an adequately placed pudendal block are believed to be nearly as effective as standard lumbar epidural analgesia (Stephens & Ford, 1997).

Providing adequate pain relief can be problematic, especially in areas where personnel or facility limitations dictate choices. In 1992 the Department of Defense made the availability of lumbar epidural services mandatory to all laboring patients (Zapp & Thorne, 1995). Before this time women who delivered in a military health care facility did so with intravenous analgesia or no analgesia. The dilemma for small military facilities was how to offer a labor epidural service without additional manpower. Intrathecal narcotics were offered as a possible alternative to meeting these demands. A study by Zapp and Thorne in 1995 measured the effectiveness of intrathecally injected opioids in relieving pain during the first stage of labor. Results concluded intrathecal analgesia provided adequate pain relief, proved cost effective, and was less labor intensive for the anesthesia provider because the provider was not required to be present after the injection of the intrathecal narcotic.

Statement of the Problem

Traditionally obstetricians have insisted epidural analgesia be delayed until the active stage of labor. Several studies have shown an increase in the length of labor for women who received epidurals in the latent labor phase prior to active labor (Thorp et al., 1993; Ramin, Gambling, Lucas, Sharma, Sidawi, & Leveno, 1995). Although most studies

document negligible effects on uterine activity when intrathecal narcotics are used, they rarely examine the timing of the initial injection of the intrathecal narcotic and its effect on the length of labor. Thus, the effect of the timing of the initial intrathecal narcotic injection on the length of the stages of labor and on total length of labor in primiparas and multiparas is unknown. The length of labor in parturients receiving intrathecal narcotics compared to parturients receiving no regional anesthesia is also unclear.

Null Hypotheses

The null hypotheses for this study are:

1. There is no difference in the first stage of labor for parturients receiving an initial intrathecal narcotic injection during early labor compared to those receiving an initial intrathecal narcotic injection in advanced labor compared to those receiving no regional anesthesia.
2. There is no difference in the second stage of labor for parturients receiving an initial intrathecal narcotic injection during early labor compared to those receiving an initial intrathecal narcotic injection in advanced labor compared to those receiving no regional anesthesia.
3. There is no difference in the total length of labor for parturients receiving an initial intrathecal narcotic injection during early labor compared to those receiving an initial intrathecal narcotic injection in advanced labor compared to those receiving no regional anesthesia.

Dependent Variables

The dependent variables which will be measured retrospectively in this study are:

1. The length of the first stage of labor in minutes.
2. The length of the second stage of labor in minutes.
3. The length of the first and second stages which equals the total length of labor in minutes.

Conceptual Framework

Defining and diagnosing labor is essential in understanding how various drugs can influence the progress of labor. Emanuel A. Friedman's physiological model defined the stages of labor, the objectives of labor, and the time for each stage of labor. There are three stages of labor. This study focused on the first two stages of labor.

The first stage of labor begins with the onset of regular uterine contractions and ends when the cervix is fully dilated (Friedman, 1978). It can be further divided into latent and active phases. The latent phase or early labor is described as the onset of regular uterine contractions with cervical dilation up to three to four centimeters and effacement but without fetal descent. The latent phase of labor appears to be involved with orientation, coordination, and polarization of uterine contractions and with preparation of the cervix for later active dilation. The latent phase is normally less than 20 hours in primiparas and less than 14 hours in multiparas. Durations of labor exceeding these time ranges are diagnosed as a prolonged latent phase of labor.

The active phase of labor is described as the time at which the rate of cervical dilation begins to increase. The distance of cervical dilation plotted against time shows an

increase in the slope of the curve when the active phase begins. The normal active phase rate of dilation for primiparas is at least 1.2 centimeters per hour and at least 1.5 centimeters per hour for multiparas.

The active phase of labor can be further divided into the acceleration phase, the phase of maximum slope, and the deceleration phase. The acceleration phase occurs when the cervix dilates rapidly. The speed of the acceleration phase is a predictor of the total time of active phase. A slow acceleration phase indicates a prolonged total labor as a rapid acceleration phase indicates a short total labor. The phase of the maximum slope is a measure of the muscular effectiveness of the uterus when most of the cervical dilation occurs.

The second stage of labor begins with complete cervical dilation and ends with the birth of the baby. Contractions during this stage are expulsive and the woman usually feels an irresistible desire to bear down. The normal rate of descent is at least one centimeter per hour in primiparas or two centimeters per hour in multiparas. The diagnosis of prolonged second stage occurs when primiparas are in second stage longer than two hours and multiparas longer than one hour. In 1988, The American College of Obstetrics and Gynecology extended the time for making the diagnosis for women receiving regional anesthesia to more than three hours for primiparas and more than two hours for multiparas (Shnider & Levinson, 1993). The third stage of labor begins with the birth of the baby and ends with the delivery of the placenta.

There are no fixed values for the normal length of the first and second stages of labor because of the variations in client population and in clinical practice. Friedman (1978)

however, does provide averages and upper statistical limits for the first and second stage, which are generally accepted as the standard in the obstetrical community (See Table 1). The average time for each stage for a patient receiving intravenous oxytocin infusion is also included in Table 1.

Table 1.

Mean Values of Various Components of Labor

Group	First Stage Latent Phase (in minutes)	First Stage Active Phase (in minutes)	Second Stage (in minutes)
Primiparas			
Mean	366	204	46
Mean with Oxytocin	216	186	57
Multiparas			
Mean	270	126	19
Mean with Oxytocin	192	114	10

Conceptual Definitions

The following definitions, terms and concepts are used in this study (Brown, 1996; Katzung, 1992; Shnider & Levinson, 1993).

Analgesia. Diminished sensation of pain, particularly the relief of pain without loss of consciousness.

Epidural analgesia. Analgesia produced by introduction of a dilute solution of local anesthetic, with or without an opioid, into the epidural space of the vertebral canal.

Spinal analgesia. Analgesia produced by introduction of an opioid into the subarachnoid space of the vertebral canal.

Anesthesia. Loss of feeling or sensation produced by a number of agents capable of bringing about partial or complete loss of sensation induced primarily to permit the performance of surgery or other painful procedures.

Epidural anesthesia. Anesthesia produced by injection between the ligamentum flavum and the dura into the epidural space, also called the extradural or peridural space.

Spinal anesthesia. Anesthesia produced by injection of anesthetic agent into the subarachnoid space between the subarachnoid mater and the pia mater usually producing block of motor, sensory, and autonomic neurons.

Local anesthetic. A chemical agent which produces the blockade of nerve conduction resulting in transient loss of sensory or motor capabilities.

Opioids. Chemical substances, which are either endogenous or exogenous to the body, that bind specifically to any of the several opioid receptors and produce some agonist opiate effect.

Uterine activity. The frequency and intensity of uterine contractions.

Progress of labor. Increasing cervical dilation and effacement and the descent of the presenting part of the fetus in the maternal pelvis.

Abnormal progress of labor. Labor with a prolonged latent phase, a slow slope active phase, an active phase arrest with no further dilation or protracted descent or an arrest of descent.

Dilation. The gradual opening of the cervix of the uterus.

Effacement. The thinning, softening and relaxation of the lower portion of the uterus as the myometrial fibers relax and become longer to facilitate fetal expulsion during second stage of labor.

Oxytocics. Pharmacological agents that stimulate uterine contractions used to induce or augment labor and control postpartum bleeding and uterine atony.

Operational Definitions

The following are the operational definitions for this study (Friedman, 1978; Shnider & Levinson, 1993).

First stage of labor. The time in minutes from the start of active labor to the time of complete cervical dilation and effacement. For the purposes of this study, the time of active labor is determined by the parturient and the time she states regular and painful uterine contractions began.

Second stage of labor. The time in minutes from full cervical dilation to the time of delivery of the fetus.

Early labor. The time from two centimeters of cervical dilation to four centimeters of cervical dilation.

Advanced labor. The time from five centimeters of cervical dilation to ten centimeters of cervical dilation.

Instrumental delivery. Delivery of the fetus through the vagina with a device such as forceps or vacuum extraction.

Assumptions

The assumptions of this study are:

1. The latent stage of labor is from zero to four centimeters of cervical dilation.
2. The active stage of labor is from five to ten centimeters of cervical dilation.
3. Active labor begins from the time of regular, painful uterine contractions. Often the patient must be relied upon to provide this information.

Limitations

The limitations in this study include:

1. The statistical norms established by Friedman were originally done in the 1950s and updated in the 1970s. However, since that time obstetric practice and the childbearing population have changed and therefore the averages may need to be updated.
2. The latent phase of labor is dependent on the self-diagnosis of the parturient who vary in their recognition of and response to painful contractions.
3. There is variability intrinsic in human labor and approaches vary in obstetrical management.
4. Randomness in selection of the retrospective sample is obtained passively by selecting subjects who happen to fall within the original retrospective chart review.

Summary

Regional anesthesia for labor and delivery has gained widespread use because of its effectiveness and safety when properly administered. It is common practice for many obstetricians to delay the initiation of regional analgesia until the active phase has been

established to avoid interference with the progress of labor. However, it is often difficult to identify the beginning of the active phase of labor. It is unclear how the timing of the initial injection of intrathecal narcotics effects uterine activity and thus length of labor. This study measured the length of first stage, second stage and total length of labor for parturients who received their initial intrathecal injection either in early or advanced labor. The results were compared to the average length of labor established by Friedman (1978) and against a no regional group to determine if the timing of the initial intrathecal injection increased, decreased or had no effect on the length of labor.

CHAPTER II: REVIEW OF LITERATURE

Administration of local anesthetics and opioids via the epidural route has emerged as an increasingly popular approach to pain relief. In some medical centers, virtually all parturients receive epidural analgesia. This widespread practice has received scrutiny because of reports indicating epidural analgesia interferes with labor, especially if initiated in the latent phase (Thorp et al., 1993; Ramin et al., 1995). However, randomized studies designed to examine the effects of epidural analgesia on labor are conflicting and often inconclusive. The discovery of opioid receptors in the spinal cord spurred an interest in using intrathecal opioids for pain relief. Numerous studies indicate intrathecal narcotics do not appear to significantly alter the natural progression of labor (Stephens & Ford, 1997).

To discern how intrathecal narcotics act in the spinal cord, it is necessary to understand the physiology of labor pain. Pain during the first stage of labor is primarily related to repetitive uterine contractions and resultant cervical dilation (Stephens & Ford, 1997). Neural impulses travel along visceral afferent fibers entering the spinal cord at the thoracic 10-12 and lumbar one spinal segments. The pain associated with the first stage of labor is primarily transmitted by slowly conducting nerves (unmyelinated C fibers) and constitutes visceral pain, which is modulated at the level of the dorsal horn of the spinal cord gray matter. Visceral pain is typically dull or aching in character.

During the second stage of labor, separate mechanisms are involved. Stretching of the perineum results in painful stimuli that travel along the pudendal nerve and enter the neural axis at the spinal sacral two through four segments. Quickly conducting nerves

(myelinated A δ fibers) transmit impulses related to the second stage of labor, resulting in somatic pain. These signals typically undergo little modulation before arriving at the cerebral cortex and are perceived as sharp or burning in quality (Stephens & Ford, 1997).

The intrathecal space occupies the area between the dura mater and the spinal cord through which cerebrospinal fluid circulates. Opioid receptors are densely concentrated at the level of the substantia gelatinosa of the dorsal gray spinal matter. Intrathecal narcotics specifically bind to opioid receptors at this level and inhibit transmission of afferent visceral pain impulses. Since visceral pain is modulated at the level of the dorsal horn, intrathecal narcotics provide adequate relief of visceral pain associated with the first stage of labor but do not affect somatic pain associated with perineal stretching during the second stage of labor (Stephens & Ford, 1997).

In the late 1970s, through a series of animal experiments, opiate receptors were identified autoradiographically in the brain and the substantia gelatinosa of the spinal cord (Pert, Kuhar, & Snyder, 1976; Atweh & Kuhar, 1977). A significant finding was the identification of a very dense localization of opiate receptors known to receive the primary afferent synapses of small myelinated A δ and unmyelinated C fibers. These fibers are important in relaying nociceptive information from visceral and somatic organs to higher centers. In the spinal cord, these fibers carry sensory information for most of the body.

Subsequent studies confirmed that the administration of morphine into the subarchnoid space of rats produced potent analgesia (Wang, 1977). These effects were then clinically applied in man for the relief of intractable pain (Wang et al., 1979). Eight

patients were included in the study. Patients received either saline solution or 0.5 to 1.0 mg of morphine intrathecally. Six of the eight patients were able to distinguish morphine from the placebo and believed they had obtained satisfactory and relatively long-lasting relief.

A study conducted by Yaksh, Wilson, Kaiko and Inturrisi in 1979, experimentally used intrathecal morphine in the parturient rat and rabbit without any detectable effect on labor length or the viability of the newborn. These results prompted further investigation into the use of intrathecal morphine in human labor. In 1981, Baraka, Noueihid and Hajj studied 20 primiparous women who received either one or two mg of morphine injected intrathecally when the cervix was at least three centimeters dilated. The results indicated one or two mg of intrathecal morphine could completely relieve the visceral type of labor pain for periods lasting eight to 11 hours. However, morphine did not block pin-prick sensation and similar somatic sharp localized pain, such as that induced by episiotomy or by stretching of the vulva and perineum. The onset of intrathecal morphine was slow, often requiring 15 to 60 minutes to take effect. This delay was attributed to morphine's poor lipid solubility and its slow access to the receptor sites. There were no significant differences between the rates of cervical dilatation between the two groups. However, the one mg group did not require any oxytocin administration, while the two mg group necessitated augmentation in 61.5 percent of the cases. Systemic maternal side effects such as somnolence, nausea, vomiting, and itching occurred in a high proportion of the parturients. In the majority of cases, these side effects were mild and were effectively reversed by naloxone.

Another study conducted in 1984 investigated whether smaller doses of morphine would effectively relieve the pain of labor while decreasing the incidence of side effects (Abboud et al., 1984). Thirty healthy women in active labor received an intrathecal injection of morphine 0.5 mg or 1 mg in 7.5 percent dextrose. Analgesia began 15 to 60 minutes after injection and lasted six to eight hours. Again, analgesia proved effective for the first stage of labor but not the second stage. The mean cervical dilatation immediately before receiving morphine was approximately six centimeters. Forty-three percent of patients required oxytocin augmentation, which was commenced before or at the time of the administration of morphine. Twenty-seven patients delivered vaginally. Seventy-four percent of these patients had normal progress of the first stage of labor and 59 percent had normal duration of second stage. However, 55 percent of the primiparas had a prolonged second stage. Significant side effects were reported which included pruritus, nausea or vomiting, urinary retention, and drowsiness. These side effects were decreased by naloxone which did not affect the degree of analgesia.

Although intrathecal morphine provided significant labor analgesia and did not appear to significantly interfere with the progress of labor, ensuing studies focused on opiates with faster onset times and less significant side effects. Adding the lipid-soluble narcotic fentanyl to intrathecal morphine solved the problem of slow onset (Leighton et al., 1989). With a sample size of 15 parturients, a dose of fentanyl 25 μ g and morphine 0.25 mg in two ml was injected intrathecally. Analgesia was achieved in less than five minutes and lasted until delivery in 60 percent of the patients. The remaining 40 percent ultimately required conventional lumbar epidural analgesia with local anesthetics. The mean

cervical dilation before intrathecal narcotics were administered was approximately five centimeters. The mean duration of the first stage of labor was approximately 240 minutes for primiparas and 95 minutes for multiparas. The mean length of second stage was approximately 150 minutes for primiparas and 41 minutes for multiparas. The results are indicative of a normal first and second stage for parturients receiving regional anesthesia. However, even with a lower dose of morphine the side effects of itching and vomiting continued.

In 1993, Grieco and colleagues compared the effects of adding epinephrine 200 μg and morphine 250 μg to intrathecal sufentanil ten μg to prolong labor analgesia. The mean cervical dilation at the time of injection for all groups was approximately three centimeters. The mean duration of first stage of labor for all groups was between 660 to 900 minutes and 110 to 122 minutes for the second stage. Although length of labor was not the focus of the study, there does appear to be an increase in labor length in the first stage of labor with all the combinations of intrathecal narcotics. The study did conclude that although morphine prolonged labor analgesia, the side effects of maternal nausea and pruritus continued at a relatively high rate.

In 1995, Campbell, Camann and Datta concluded the addition of 2.5 μg of bupivacaine to ten μg of intrathecal sufentanil significantly prolonged the duration of labor analgesia in primipara patients compared to either drug alone. Because of the low dose, the degree of motor blockade was minimal. The mean cervical dilation at the time of injection was approximately four centimeters, however there was no mention of the effects on length of labor in the study.

Many smaller community based hospitals with limited anesthesia personnel, began offering intrathecal narcotics to their obstetric population and found it to be an adequate and cost-effective alternative to epidural analgesia. At Hanford Community Medical Center in California, obstetric epidural anesthesia was not readily available because of the limited number of anesthesiologists on staff and a protocol for intrathecal anesthesia was implemented (Rust, Waring, Hall, & Nelson, 1994). Through a retrospective chart review, 90 patients who received an intrathecal injection of fentanyl 25 to 30 μ g, plus 0.25 to 0.3 mg of morphine and six to eight mg of one percent lidocaine were compared to 90 patients in a control group. At the time of narcotic injection, cervical dilation ranged from three to seven centimeters, and the duration of labor after injection ranged from 45 to 650 minutes. There was no statistical difference in the use of oxytocin for induction or for augmentation of labor between treatment and control patients. The average second stage in the treatment group was longer than that of the control group, however the length was still within the normal range. The operative delivery rate in the intrathecal group was 51 percent compared with 29 percent for the control group. The difference was accounted for by a higher number of primigravid women in the intrathecal group.

Another study conducted at a military facility in Germany evaluated the effectiveness of 25 μ g of fentanyl and 0.25 mg of intrathecal morphine and made comparisons to a no regional control group (Herpolsheimer & Schretenthaler, 1994). Each group contained 75 patients. The first stage of labor was approximately 530 minutes for the regional group compared to 475 minutes for the control group. The second stage of labor was

approximately 36 minutes for both groups. There was no significant increase in the use of oxytocin in either group.

Summary

The majority of intrathecal studies focused on comparing various combinations of narcotics to determine which ones provided longer analgesia time with fewer side effects. However, no consensus had been reached as to the optimal drug or dosage. Although most studies document negligible effects on uterine activity, regardless of the combination of narcotics used, they rarely examined the timing of intrathecal narcotics and the effect on length of labor. The length of labor was usually added as a supplement but was not the primary focus of the study. Controversy in obstetric anesthesia continues to involve the effects of regional analgesia on the progress and outcome of labor. The findings of this study augment the existing body of knowledge related to the viability of intrathecal analgesia as a potential alternative to epidural anesthesia.

CHAPTER III: METHODOLOGY

Introduction

The purpose of this study was to analyze the relationship between the initial timing of intrathecal narcotics and first stage, second stage and the total length of labor. Patients receiving intrathecal narcotics in early labor were compared to patients receiving intrathecal narcotics in advanced labor and to patients receiving no regional anesthesia. A retrospective review of an existing database assembled by Cutbush (1997) was conducted. Subjects who received intrathecal analgesia and subjects who received no regional anesthesia were selected from the database.

Sample

The database included 213 low risk homogenous parturients. Subjects included active duty military personnel, dependents of active duty or retired military personnel with term, low risk, singleton pregnancies. The data were collected between October 1996 to March 1997 from a 70 bed Air Force hospital with an obstetrical service that performed approximately 100 to 120 deliveries per month. Subjects were placed in one of four groups based upon the type of analgesia received in labor. This study focused on the intrathecal and the no regional anesthesia group. The total study sample consisted of 96 subjects.

Instrumentation

Data collection was done through chart reviews. The data were encoded numerically and entered into a Statistical Package for the Social Sciences (1997) database

spreadsheet, with each column representing a variable and each row representing data from each record (See Appendix).

Research Design

Subjects were initially identified from the labor and delivery hospital log book. This book tracked all obstetrical deliveries with information such as the length of each stage of labor and the type of anesthesia that each woman received. Demographic data and other information were obtained from the perinatal record and the mother's inpatient chart. Charts were reviewed chronologically for the last 50 patients who received combined spinal-epidural, epidural, intrathecal or no regional anesthesia.

The women in this study received analgesia upon request during their labor. The type of analgesia and anesthesia administered was a cooperative decision made by the patient, obstetrician and the anesthesia provider. The anesthesia department followed a protocol for intrathecal narcotics of either (1) fentanyl 25 µg, 2.5 mg of bupivacaine and 200 µg of epinephrine, (2) fentanyl 25 µg, sufentanil 10 µg, 3 mg of bupivacaine and 200 µg of epinephrine or, (3) 2.5 mg of bupivacaine and 200 µg of epinephrine. One of these drug combinations was administered intrathecally using a 27 gauge Whitacre spinal needle inserted through an 18 gauge Tuohy epidural needle. Using sterile technique, injections were made at the lumbar 2-3 to lumbar 4-5 intravertebral space with the patient in the sitting or lateral decubitus position. An obstetric nurse recorded vital signs and respiratory rate every 15 minutes until delivery and every hour for the succeeding 12 hours.

In this study Group I included women who received intrathecal anesthesia. This group was divided into Group IA and IB. Group IA included women who received their initial intrathecal narcotic injection when their cervix was dilated between two and four centimeters during labor. Group IB included women who received their initial intrathecal narcotic injection when their cervix was dilated between five and ten centimeters during labor. The no regional anesthesia group was Group II and was the control group. The length of the first stage of labor, the second stage of labor and the total length of labor of Group IA was compared to Group IB and the control Group II.

Groups IA, IB and II were further subdivided into primipara women and multipara women. The mean length of first stage, second stage and total labor of primipara women was compared to the length of the first, second and total labor of multipara women. Finally, the use of oxytocin among the three groups was also examined.

Statistical Analysis

Data for study variables were summarized in frequency distributions, averages, standard deviations and where appropriate, standard errors. An ANOVA was performed to determine if there was a statistically significant difference in the duration of the first stage, second stage or total length of labor among women who received early intrathecal injection, advanced intrathecal injection and no regional analgesia. Post hoc multiple comparison tests were performed using Tukey's honestly significant difference test for pairs of means. The statistical significance level chosen was $p < 0.05$.

Protection of Human Subjects

For the purpose of protecting human subjects a proposal was developed and submitted to the Uniformed Services University of the Health Sciences Institutional Review Board (IRB). The proposal was reviewed by the IRB committee and approved on 8 May 1998. No subject names were provided to the principal investigator from the database.

CHAPTER IV: RESULTS

Introduction

Ninety-six patients were included in this study to analyze the relationship between the initial timing of intrathecal narcotics and the duration of first stage, second stage and the total length of labor. Of the 49 patients included in the intrathecal group, 16 patients received intrathecal narcotics in the early stage of labor and 31 received intrathecal narcotics in the advanced stage of labor. Forty-seven patients were included in the no regional group. Two patients had cesarean sections and were included in the sample characteristics but excluded from the data analysis.

Characteristics of the Study Sample

The demographic characteristics of maternal age, height, weight and gestation are shown Table 2. As shown in Table 3, 70 percent of the sample consisted of Caucasians, while the remaining sample consisted of African-American (20 percent), Hispanic (four percent) and Asian (five percent). Forty-five percent of the primipara women were in the intrathecal group and 55 percent were in the no regional group. Thirty-two percent of the multipara women were in the intrathecal group and 68 percent in the no regional group. The average dilation for receiving intrathecal narcotics was six centimeters. Both groups had similar incidences of vaginal delivery along with a low incidence of instrumental delivery and cesarean section. Sixty-seven percent of the intrathecal group and 38 percent of the no regional group were given oxytocin for induction or augmentation.

Table 2.**Characteristics of the Study Sample**

Characteristic	Intrathecal	No Regional
Age (years)	25 $\pm$ 5	25 $\pm$ 5
Height (cm)	65 $\pm$ 2	65 $\pm$ 8
Weight (kg)	80 $\pm$ 14	78 $\pm$ 11
Gestation (wk)	40 $\pm$ 1	40 $\pm$ 1
Primipara (number)	22	15
Multipara (number)	27	32
Dilation (cm)	6 $\pm$ 2	N/A
SVD	44	45
Cesarean Section	2	1
Oxytocin	33	18
Total	49	47

Table 3.**Race of Study Sample**

Race	Intrathecal	No Regional
Caucasian	31	37
African-American	12	7
Hispanic	2	2
Asian	4	1
Total	49	47

Dilation at Time of Injection

Dilation at time of injection is shown in Table 4. More subjects were contained in the advanced group compared to the early group.

Table 4.**Cervical Dilation at Time of Early and Advanced Intrathecal Narcotic Injection**

Dilation (centimeters)	Early Intrathecal (number of subjects)	Advanced Intrathecal (number of subjects)
2	2	
3	5	
4	10	
5		8
6		8
7		6
8		8
9		2
Total	17	32

Calculation of Mean Length of Each Stage of Labor

The average length of each stage of labor is shown in Table 5 and Figure 1. The length of the first stage of labor was calculated as the time in minutes from the start of active labor to the time of complete cervical dilation and effacement. Second stage of labor was calculated as the time in minutes from full cervical dilation to the time of

delivery of the fetus. The total length of labor was calculated by adding the sum of the first and second stage of labor.

One-way analysis of variance (ANOVA) was used to determine the statistical significance of the difference in mean lengths of first stage, second stage and total length of labor among patients who received early intrathecal narcotic injection, advanced intrathecal narcotic injection and no regional analgesia. Post hoc multiple comparison tests were performed using Tukey's honestly significant difference test for pairs of means. The statistical significance level chosen to show a difference in groups was $p < 0.05$. No groups were significantly different in the first stage ($p = .624$) or total length of labor ($p = .375$). There was a statistically significant increase in the length of second stage labor in the advanced group compared to the early group ($p = .034$).

Table 5.

The Length of Labor by Analgesia

Time of Narcotic	First Stage (Minutes) Mean+SD	Second Stage (Minutes) Mean+SD	Total (Minutes) Mean+SD
Early	310 $\pm$ 253	36 $\pm$ 42	346 $\pm$ 250
Advanced	356 $\pm$ 163	49 $\pm$ 47	403 $\pm$ 178
No Regional Anesthesia	330 $\pm$ 153	25 $\pm$ 26	346 $\pm$ 162

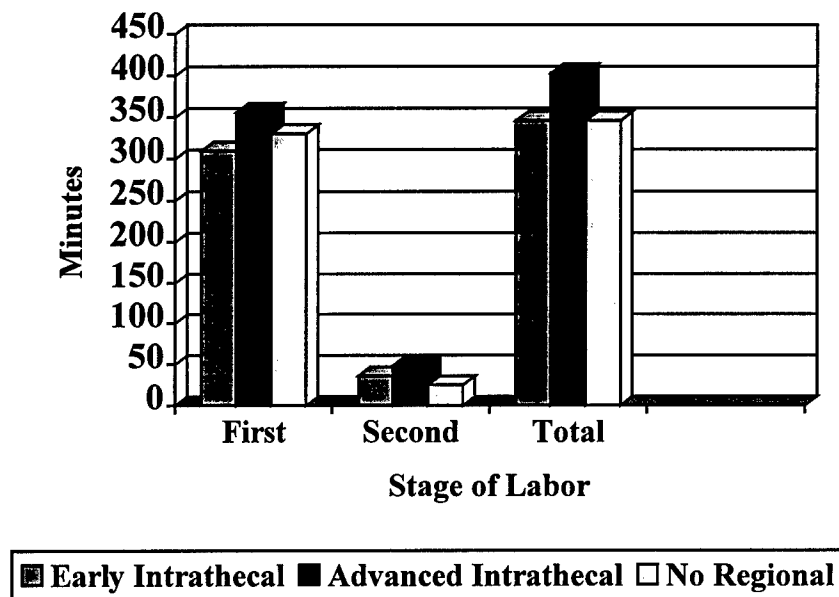


Figure 1.

Mean Length in Minutes of Each Stage of Labor

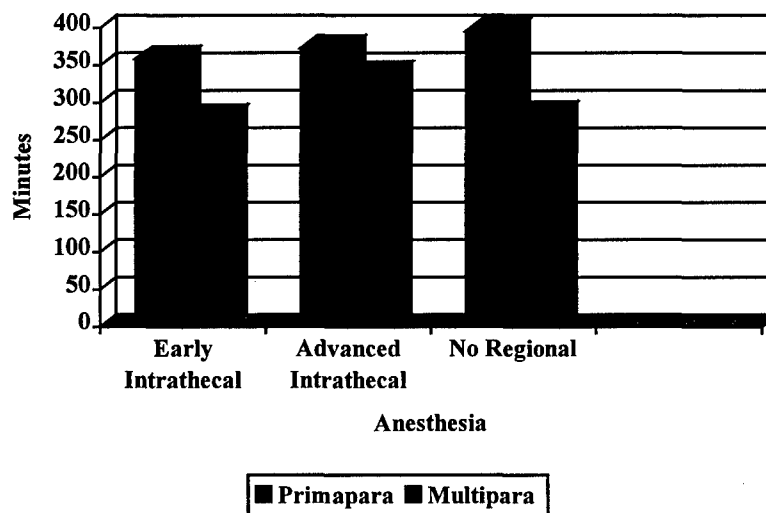
The Length of the Stages of Labor for Primipara and Multipara Women

The average length of each stage of labor according to parity and timing of intrathecal narcotics are shown in Table 6 and Figures 2, 3, and 4. There was no significant difference among parity and timing for the first stage of labor ($p=.301$) and total length of labor ($p=.067$). There was a significant increase in the length of the second stage of labor for primipara women receiving intrathecal narcotics in the advanced stage of labor compared to those primipara women who received intrathecal narcotics in the early stage of labor ($p=.000$).

Table 6.**The Length of Labor by Analgesia and Parity**

Time of Intrathecal Narcotic	Parity	Number of Subjects Total=94	First Stage (Minutes) Mean $\pm$ SD	Second Stage (Minutes) Mean $\pm$ SD	Total (Minutes) Mean $\pm$ SD
Early	Primipara	6	359 $\pm$ 258	46 $\pm$ 22*	404 $\pm$ 294
Advanced	Primipara	15	373 $\pm$ 173	70 $\pm$ 58*	443 $\pm$ 200
Early	Multipara	10	281 $\pm$ 235	30 $\pm$ 51	311 $\pm$ 230
Advanced	Multipara	16	338 $\pm$ 159	28 $\pm$ 5	366 $\pm$ 151
No Regional	Primipara	15	396 $\pm$ 147	45 $\pm$ 31	441 $\pm$ 161
No Regional	Multipara	32	285 $\pm$ 148	17 $\pm$ 18	302 $\pm$ 145

*p<0.05

**Figure 2.****The Length of First Stage Labor for Primiparas and Multiparas**

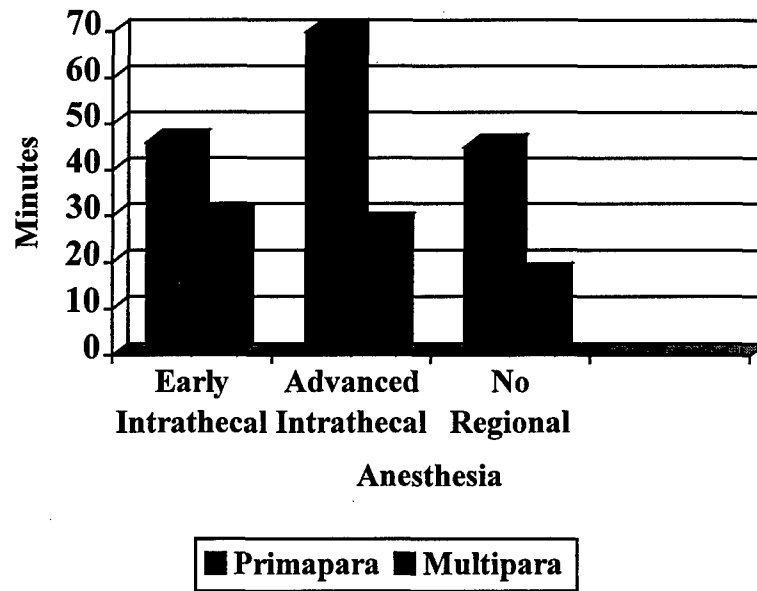


Figure 3.

The Length of Second Stage Labor for Primiparas and Multiparas

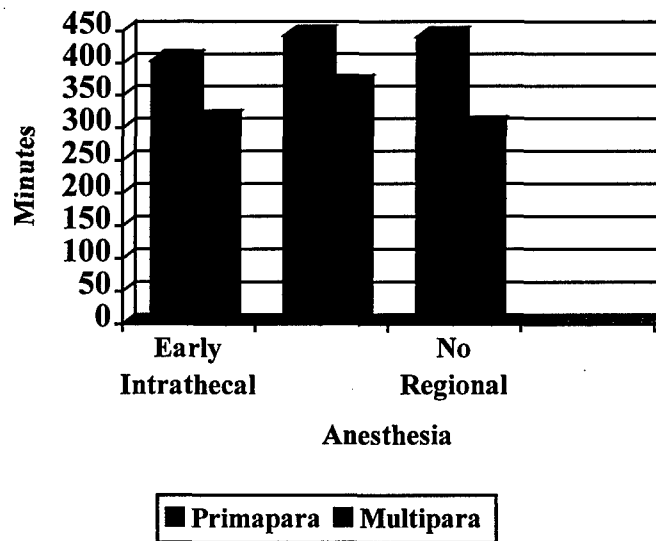


Figure 4.

The Length of the Total Length of Labor for Primiparas and Multiparas

Intrathecal Narcotics and the Use of Oxytocin

The number of subjects receiving oxytocin either for induction or augmentation are shown in Table 7. Eighty-one percent of the early intrathecal group received oxytocin compared to 58 percent of the advanced intrathecal group compared to 38 percent of the no regional control group.

Table 7.**Oxytocin Administration for Intrathecal and No Regional Groups**

Oxytocin	Early Intrathecal	Advanced Intrathecal	No Regional
Induction/Augmentation	13 (81%)	18 (58%)	18 (38%)
None	3 (18%)	13 (42%)	29 (61%)
Total	16	31	47

CHAPTER V: DISCUSSION

Introduction

A retrospective review of an existing database assembled by Cutbush (1997) was conducted to determine the relationship between the initial timing of intrathecal narcotics and first stage, second stage and total length of labor. The controversies in obstetric anesthesia include the effects of regional analgesia on the progress and length of labor. Although most studies document negligible effects on uterine activity when intrathecal narcotics are used, they rarely examine the effect of the timing of the initial injection of the intrathecal narcotic and its effect on the length of labor.

In this study, patients receiving intrathecal narcotics in early labor (between two and four centimeters of cervical dilation) were compared to patients receiving intrathecal narcotics in advanced labor (between five and ten centimeters of cervical dilation) compared to patients receiving no regional anesthesia. The study further compared the mean length of each stage of labor according to parity and timing of intrathecal narcotics and the mean length of each stage of labor according to parity and the use of oxytocin.

Study Demographics

The sample was obtained from a military hospital and consisted of women with low risk pregnancies who had similar demographic characteristics. Of the 96 women enrolled in the study, 49 were in the intrathecal group and 47 were in the no regional group. Two women receiving cesarean sections were not included in the data analysis because the timing of each stage of labor could not be determined. There was no significant difference between the groups as to demographic data, gestational age, parity, or cervical

dilation at the time of administration of intrathecal narcotics. Both groups had a similar incidence of instrumental delivery and cesarean section. Finally, 70 percent of the sample were Caucasian women. These findings between the groups may not be different among subjects with a more varied ethnic background.

The Effect of Intrathecal Narcotics on Length of Labor

This study used Emanuel A. Friedman's (1978) physiological model to define stages of labor. The first stage of labor was defined as the time in minutes from the start of active labor to the time of complete cervical dilation and effacement. For the purposes of this study, the time of active labor was determined by the parturient and the time she stated regular and painful uterine contractions began. The second stage of labor was defined as the time in minutes from full cervical dilation to the time of delivery of the infant. The total length of labor was defined as the sum of the length of the first and second stage of labor.

This study found no difference in the first stage of labor for parturients receiving an initial intrathecal narcotic injection during early labor compared to those receiving an initial intrathecal narcotic injection in advanced labor compared to those receiving no regional anesthesia. The average length of first stage labor in minutes was 310 for the early intrathecal group, 356 for the advanced intrathecal group and 330 for the no regional group. All three groups had means for the first stage of labor below the suggested statistical norms of Friedman (1978). Thus, the timing of intrathecal narcotics does not effect the length of the first stage of labor in this study. This compares to the findings of a 1989 study evaluating the use of intrathecal morphine and fentanyl in labor.

The study concluded intrathecal narcotics had no effect on the first stage of labor (Leighton et al., 1989).

This study found the advanced intrathecal group had a statistically significant longer second stage. The average length of second stage labor was 36 minutes for the early intrathecal group, 49 minutes for the advanced intrathecal group and 25 minutes for the no regional group. The advanced intrathecal group also had a length of second stage labor greater than that suggested by Friedman (1978), with 19 minutes for multiparas and 46 minutes for primiparas. It can be concluded from the data that administering intrathecal narcotics in advanced labor prolongs second stage labor. This finding is supported by a study conducted by Abboud and colleagues (1984) evaluating the effectiveness of intrathecal narcotics in labor. The study concluded intrathecal narcotics prolong second stage labor in primipara women.

This study found no difference in the total length of labor for parturients receiving an initial intrathecal narcotic injection during early labor compared to those receiving an initial intrathecal narcotic injection in advanced labor compared to those receiving no regional anesthesia. The average length of labor was 346 minutes for the early intrathecal group, 403 minutes for the advanced intrathecal group and 346 minutes for the no regional group with no significant difference among the groups. The norms established by Friedman (1978) for total length of labor were 616 minutes for primiparas and 415 minutes for multiparas. The three groups were below these values. Thus, the timing of intrathecal narcotics does not effect total length of labor. Studies conducted in 1984 and 1989 evaluating the effectiveness of intrathecal narcotics in labor support the

findings that intrathecal narcotics do not effect total length of labor (Abboud et al., 1984; Leighton et al., 1989).

The Effect of Parity on the Length of Labor

The mean length of each stage of labor according to parity and timing of intrathecal narcotics is shown Table 6 of Chapter 4. The only significant difference was a prolonged second stage labor for primiparas receiving intrathecal narcotics in the advanced stage of labor. Friedman's (1978) established norms for first stage labor were 570 minutes for primiparas and 396 minutes for multiparas. All groups in the study were below these values. Friedman's established norms for second stage labor were 46 minutes for primiparas and 19 minutes for multipara women. Primipara women receiving advanced intrathecal narcotics fell out of this range at 70 minutes. Also, multipara women receiving intrathecal narcotics in both early and advanced labor were above these values of 30 and 28 minutes respectively.

This study showed length of the second stage of labor was prolonged for primipara women who received intrathecal narcotics in advanced labor. It also suggested multipara women who received intrathecal narcotics in either early or advanced labor could have a prolonged second stage. This finding was supported by the 1984 study conducted by Abboud and colleagues who concluded intrathecal narcotics prolong second stage labor in primipara women.

The Effect of Intrathecal Narcotics on the Use of Oxytocin

Oxytocin is a pharmacological agent used to stimulate uterine contractions and is administered to induce or augment labor. As shown in Table 7, 81 percent of the early

intrathecal group received oxytocin compared to 51 percent of the advanced intrathecal group. Sixty-one percent of the no regional group labored without oxytocin. Factors other than intrathecal narcotics may have attributed to the greater use of oxytocin in the intrathecal narcotic group compared to the group who did not receive regional anesthesia. Oxytocin may have been necessary to augment labor after injection of regional analgesia to maintain an adequate labor pattern. However, the women may have had other factors associated with the increase in the length of labor such as malpresentation of the infant or cephalopelvic disproportion. In addition, obstetrical providers vary in their management of labor with some being more aggressive in their use of oxytocin than others. Thus, labor augmentation may be related to several other factors besides the use of intrathecal narcotics. Another study looking at the use of oxytocin and reasons for its use after intrathecal narcotic administration needs to be conducted to make a definitive conclusion.

Study Limitations

The data for this study was obtained from a retrospective chart review, making it hard to control for biases. It was also difficult to determine the accuracy of the data recorded in the chart. The measurement variation in the initial identification of active labor by the subjects was difficult to determine. The identification of active labor was a subjective variable and the sample included a small, focused population. Analgesia was provided by anesthesia providers who used various regional techniques and anesthetic drug combinations.

Future Studies

Recommendations for future studies include a prospective randomized clinical trial to examine the effect of the timing of intrathecal narcotic administration on the length of labor. Subjects could be varied, an adequate sample size could be obtained and inclusion criteria could be monitored more closely. Finally, the number of anesthetic providers and the combination of narcotics administered should be established prior to the study's implementation.

Summary

This study found the effect of the initial timing of intrathecal narcotics and the first stage, second stage and total length of labor was minimal. The data showed that the initial timing of intrathecal narcotics had no effect on the length of first stage of labor. The administration of intrathecal narcotics in advanced labor however, did seem to prolong second stage labor. The timing of intrathecal narcotics had no effect on the total length of labor. Therefore, based on the findings of this study, intrathecal analgesia can be safely used as an anesthetic technique for labor and delivery to provide pain relief without altering the progress of labor.

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APPENDIX
SPSS DATABASE SPREADSHEET

APPENDIX

SPSS DATABASE SPREADSHEET

Case #	Age	Race	Weight	Height	Gest	Stage 1	Stage 2	Total	Anesth
--------	-----	------	--------	--------	------	---------	---------	-------	--------

Delivry	Med	Apgar 1	Apgar 5	Bweigh	Igender	Anespr	Obstpro	Gravida	Para
---------	-----	---------	---------	--------	---------	--------	---------	---------	------

Oxytoc	Dilation	TimeInj	VBAC	Csect	Wtkg	Partime	Timing	Pitpar
--------	----------	---------	------	-------	------	---------	--------	--------

Key:

Case # = cases listed in numerical order

Age = age in years

Race = race, see below

Weight = weight of parturients in kilograms

Height = height in centimeters

Gest = gestational age in weeks

Stage 1 = length of first stage of labor in minutes

Stage 2 = length of second stage of labor in minutes

Total = length of total stage of labor

Anesth = type of anesthesia received, see below for coding

Delivry = type of delivery, see below for coding

Apgar 1 = first minute apgar score (number from zero to ten)

Apgar 5 = five minute apgar score

Bweigh = birth weight in grams

Igender = infant gender

Anespr = anesthesia provider

Obstpro = obstetric provider

Gravida = gravida in numbers

Para = para in numbers

Oxytoc = induction or augmentation with oxytocin

Dilation = dilation at time of injection

TimeInj = time of initial injection on 24 hour clock

VBAC = vaginal birth after cesarean

Csect = dilation at time of cesarean delivery

Wtkg = weight in kilograms of infant

Partime = parity at time of injection, see below for coding

Timing = timing of intrathecal injection, see below for coding

Pitpar = parity and use of oxytocin during labor, see below for coding

APPENDIX (Con't)

SPSS DATABASE SPREADSHEET

Coding:

Race

1. Caucasian
2. Black
3. Hispanic
4. Asian
5. Other

Type of Delivery

1. Vaginal
2. Instrument, forceps or vacuum
3. Cesarean section

Type of Anesthesia

1. CSE
2. EPI
3. ITA
4. No Regional
5. .50%B + opioid

Medication

1. B2.5, F25, E.2
2. B3, F25, E
3. B2.5, S10, E
4. F25, E, CSF1.5

Partime

1. Primapara-early
2. Primapara-advanced
3. Multipara-early
4. Multipara-advanced
5. Primapara-no regional
6. Multipara-no regional

Pitpar

1. Primapara/early/oxytocin
2. Primapara/early/no oxytocin
3. Primapara/advanced/oxytocin
4. Primapara/advanced/no oxytocin
5. Multipara/early/oxytocin
6. Multipara/early/no oxytocin
7. Multipara/advanced/oxytocin
8. Multipara/advanced/no oxytocin
9. Primapara/no regional/oxytocin
10. Primapara/no regional/no oxytocin
11. Multipara/no regional/oxytocin
12. Multipara/no regional/no oxytocin

Timing

1. Early
2. Advanced