THE EFFECT OF MATERNAL POSITION DURING LABOR ON FETAL OUTCOME

by

Mary Ellen Carpenter, B. S.

A THESIS

Presented to
the University of Oregon School of Nursing
and the Graduate Council of the
University of Oregon Health Sciences Center
in partial fulfillment
of the requirements for the degree of

Master of Nursing
June 11, 1977

APPROVED:

[redacted]te Professor of Nursing,
Thesis Adviser

Carol [redacted]nstructor of Nursing, First Reader

[redacted]

John Bissonette, M.D., Associate Professor of Obstetrics and
Gynecology, Second Reader

Ba[redacted]ate Professor of Nursing,
Third Reader

John [redacted]Graduate Council

This study was supported by the
Department of Health, Education and
Welfare, Professional Nurse Traineeship,
Grant Number 5A11-NU00035-18
and
by the Oregon Heart Association

ACKNOWLEDGEMENTS

The candidate wishes to extend appreciation to the faculty that provided support and guidance throughout this endeavor. Special thanks is extended to Dr. John Bissonette for his assistance in statistical analysis. The candidate appreciates the cooperation received from the nursing and medical staff at the University of Oregon Health Sciences, University Hospital North, Labor and Delivery Unit. Grateful appreciation is expressed to John Larson, Sandi Studebaker and Ruby Tuesday for their patience and understanding. Finally, a special thanks to the women who participated in the study.

MEC

TABLE OF CONTENTS

Chapter		Page
I	INTRODUCTION	1
	Statement of Problem	1
	Definitions	3
	Intrapartum Fetal Monitoring	3
	Fetal Heart Rate Pattern	5
	Fetal Outcome	8
	Review of the Literature	17
	The Cultural Evolution of Position in Childbirth	17
	Position as a Nursing Intervention	20
	The Effect of Maternal Position on Body Systems in the Pregnant State	21
	The Effect of Maternal Position in Labor	25
	The Effect of Maternal Position on the Fetus	30
	Purpose of the Study	33
	Operational Definitions	33
	Hypotheses	34
II	METHODOLOGY	37
	Subjects	37
	Data Collecting Instruments	39
	Design and Data Collection Procedures	40
	Analysis of Data	41
III	RESULTS	43
	Characteristics of the Study Population	43
	Length of Labor	44
	Apgar Scores	44
	Fetal Acid-Base Status	45
	Fetal Heart Rate Patterns	46
IV	DISCUSSION	50
V	SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	54
	Summary	54
	Conclusions	55
	Recommendations	57

TABLE OF CONTENTS (continued)

Chapter		Page
	REFERENCES	58
	APPENDICES	64
	A. Informed Consent	65
	B. Raw Data	70
	ABSTRACT	

LIST OF FIGURES

Figure		Page
1	Examples of fetal heart rate baseline variability	6
2	Three major types of fetal heart rate deceleration patterns	9

LIST OF TABLES

Table		Page
1	Apgar Scoring System	10
2	Criteria for Fetal Heart Rate Classification	35
3	Mean One and Five Minute Apgar Score for the Control and Upright, Lateral Groups	45
4	Mean Umbilical Cord Blood pH Values and Incidence of pH Values Less Than 7.25 in the Control and Upright, Lateral Groups	46
5	Relation of FHR Pattern and Stage of Labor between the Control and Upright, Lateral Groups	47
6	Distribution of Dominant FHR Patterns in the Control and Upright, Lateral Groups: First and Second Stages of Labor	48

CHAPTER I

INTRODUCTION

Statement of the Problem

In most countries past and present, women have labored and delivered in either a sitting, squatting, standing or somewhat upright position. However, the majority of women in the United States labor and deliver in the recumbent position. This situation appears to have arisen for two reasons. Originally, the recumbent position evolved to facilitate the use of obstetrical forceps. Recumbency also transposed the squat position to the horizontal plane making access to the perinium easier (Blankfield, 1965). The physiological and psychological implications of the recumbent position were not examined until after the practice of recumbent labor and delivery was well established.

It has been this candidate's observation that women who labor upright and on their sides have shorter labors and fewer complications during labor. A recent study by Liu (1974) has shown that uterine contractions were significantly more frequent and effective and that the first and second stages of labor were shorter when patients were in a 30 degree upright position. Fitzhugh and Newton (1956) also observed that women in labor often attempt to elevate themselves with each uterine contraction.

With the advances of intrapartum electronic fetal monitoring, the maternal supine hypotensive syndrome associated with late pregnancy was found to correlate with a variation in the fetal heart rate designated as variable decelerations (Hon, 1973). Variable decelerations are also thought to be due to umbilical cord compression. If variable decelerations are allowed to persist, fetal outcome is jeopardized by hypoxia and the resulting asphyxia. Variable decelerations are the most common fetal heart rate pattern associated with fetal distress. The pattern often may be alleviated by maternal position change (Hon, 1973).

Nursing intervention for this condition is maternal lateral position during labor. To date, this intervention is practiced without supportive nursing research.

Previous studies implicating maternal position in fetal outcome using Apgar scores as a correlate have been inconclusive (Lui, 1974). A more precise measurement of fetal well-being is the acid-base status of the fetus at the time of delivery. This is done by measuring the pH of umbilical cord blood. Humphrey (1974) demonstrated that a decrease in fetal pH occurs during the second stage of labor, when the mother is in the dorsal position.

The above observations are assumed to influence outcome of the fetus but have not been related. The problem to be studied then, is to relate these phenomena by asking the following questions: What effect does a maternal upright lateral position during labor have on fetal outcome? How will the acid-base status of the fetus and the newborn Apgar scores be affected? What effect does a maternal upright lateral position during labor have on the fetal heart rate pattern?

Definitions

Intrapartum Fetal Monitoring

In order to evaluate and assess the status of the fetus in utero, electronic fetal monitoring was developed. Fetal monitoring employs the use of continuous electronic recording of the fetal heart rate and the timing intensity and baseline tone of the uterine contractions. It may be used in the antepartum or the intrapartum periods and the technique may be applied externally or internally.

The external method involves measurement of the fetal heart rate and maternal uterine contractions non-invasively by placing transducers on the surface of the maternal abdominal wall. This method is also referred to as indirect fetal monitoring. The fetal heart rate is measured by ultrasound. The ultrasound transmits valvular movement of the fetal heart (Lowensohn, 1976). The external tocotransducer mechanically measures the frequency of uterine contractions. The external method is often used then cervical dilation or intact membranes prohibit use of the internal method as in early labor or during the antepartal period.

The reliability of the external method is limited by the instrumentation. The ultrasound system detects heart valve motion, but the system is not limited to detection of both sets of valves. However, the ultrasound receiving unit of the transducer will not respond to another detected motion for a given interval of time after one is located. Therefore assessment of bradycardia or tachycardia is difficult (Lowensohn, 1976). In addition, variability of the fetal heart rate cannot be interpreted. Maternal obesity and position also interfere with measurement of the variability of the fetal heart rate. The external tocotransducer does not measure the intensity of uterine contractions nor the baseline tone of the uterus.

Internal fetal monitoring entails transvaginal placement of a spiral electrode superfically attached to the fetal presenting part to measure the fetal electrocardiogram. Direct fetal monitoring is another term used for internal fetal monitoring. Introduction of a plastic fluid-filled catheter through the vagina into the uterus between the uterine wall and the fetus measures directly, via a strain guage, the pressure of the uterine contractions as well as duration and frequency. The fetal electrode conducts the QRS complex to the fetal monitor which computes the R-to-R interval. This gives the corresponding instantaneous fetal heart rate (Hon, 1973). The internal technique is particularly valuable when used with high-risk patients and oxytocin augmentation or inducation of labor. The combined method of fetal monitoring utilizes the external tocotransducer and internal fetal electrode. This method is used mainly with non-augmented labors that progress normally (Lowensohn, 1976).

Fetal Heart Rate Pattern

Features observed in the fetal heart rate pattern include the baseline rate, baseline variability and the appearance and pattern of periodic changes. The significance of these patterns allows diagnosis of fetal distress and identification of the underlying threat to fetal well-being.

The baseline fetal heart rate describes the resting level of fetal heart rate activity between contractions or between changes unrelated to the contractions (Hon, 1973). The normal fetal heart rate is between 120 and 160 beats/minute. The two important baseline level changes noted are fetal tachycardia and fetal bradycardia.

Baseline variability refers to the rhythmic, short-term changes in heart rate and the beat-to-beat changes (Figure 1). The rhythmic, short-term changes in heart rate average three to five times per minute. The peak-to-peak amplitude of the rhythmic changes designates the degree of fetal heart rate variability (Hon, 1973). Increased variability is seen during periods of fetal activity and tend to be less when the fetus is inactive. Beat-to-beat changes refer to the actual changes in rate between pairs of heart beats and are usually in the range of

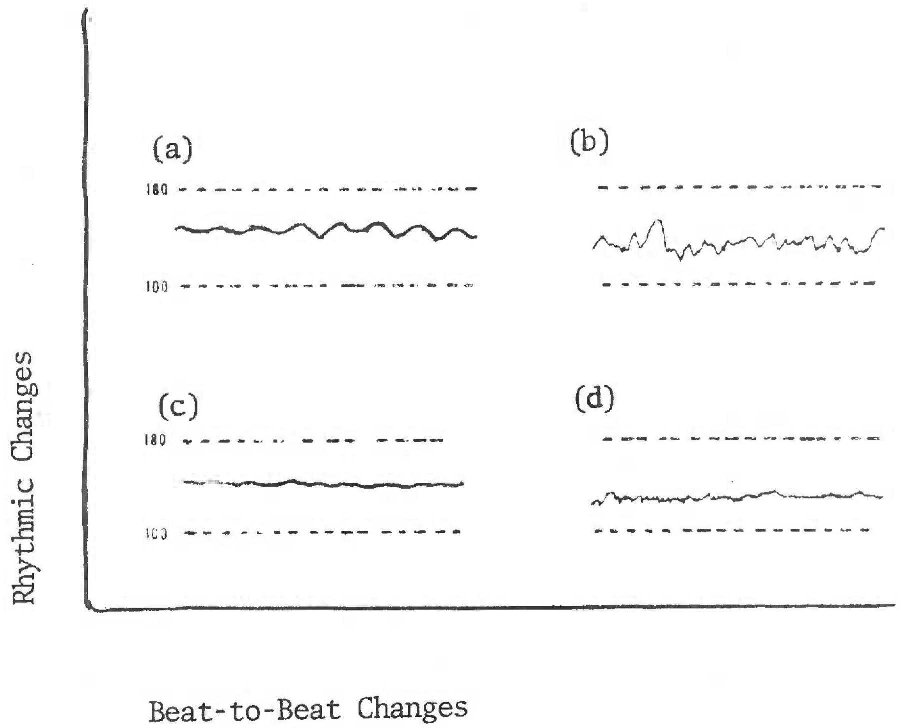

Figure 1. Examples of fetal heart rate baseline variability. (a) Normal rhythmic changes with decreased beat-to-beat changes. (b) Normal rhythmic changes and normal beat-to-beat changes. (c) Diminished rhythmic and beat-to-beat changes. (d) Reduced rhythmic changes with normal beat-to-beat changes. (Modified from, Martin, C. and Gingerich, B. Factors Affecting the Fetal Heart Rate: Genesis of FHR Patterns. Journal of Obstetrics, Gynecologic and Neonatal Nursing. (Supplement), 1976, 5, 305-305.

8-10 beats/minute. These changes are due to the interaction of the fetal nervous system with the heart beat (Martin and Gingerich, 1976). They are an indication of the integrity of the nervous system. Their absence is probably indicative of fetal compromise (Hon and Petrie, 1975). Observing decreased variability in combination with baseline level and/or periodic changes are important parameters in the diagnosis of fetal distress.

There are two components to periodic fetal heart rate changes. These are accelerations and decelerations. They are usually brief in duration and then return to the previous baseline. Periodic fetal heart rate changes are described by their waveforms and by their onset in relation to the beginning of uterine contractions. The waveforms may be either mirror images of the uterine contractions or variable in shape. Research has shown decelerations to be more life threatening to the fetus than accelerations (Martin and Gingerich, 1976).

Fetal heart rate decelerations may be produced in three major ways. Uterine contractions may exert pressure directly on the fetus especially the fetal head. These type of decelerations are designated as early decelerations. Compression of the umbilical cord between the fetus and uterine wall, pelvic wall or between fetal parts may be produced by contractions resulting in decelerations called variable decelerations. Contractions may reduce placental blood flow, therefore decreasing delivery of oxygen to the fetus and causes decelerations termed late decelerations. The deceleration patterns are designated by their relationship to the onset of the uterine contractions: early, variable, and late (Hon, 1973; Martin and Gingerich, 1976). Figure 2 illustrates the three types of fetal heart rate decelerations. They may also occur in response to fetal movement.

Accleration fetal heart rate patterns may occur with or without a contraction and usually imply a healthy fetus. The fetal heart rate increases 15 beats/minute above the baseline, and have not been associated with increased fetal morbidity or mortality (Martin and Gingerich, 1976).

Fetal Outcome

The desirable outcome of pregnancy, labor and delivery is a healthy baby and mother. The extent to which this has been accomplished with the newborn may be measured objectively and will be referred to as fetal outcome. Indices for measuring fetal outcome have developed from subjective assessment of the newborn at birth to the present ability of utilizing the Apgar scoring system, the changes in the fetal heart rate pattern during the intrapartum period and the acid-base status of the newborn at delivery. Each of these parameters will be explained in detail.

In 1953 Apgar developed a method for evaluation of the newborn at the time of delivery (Driscoll and James, 1976). This systematic

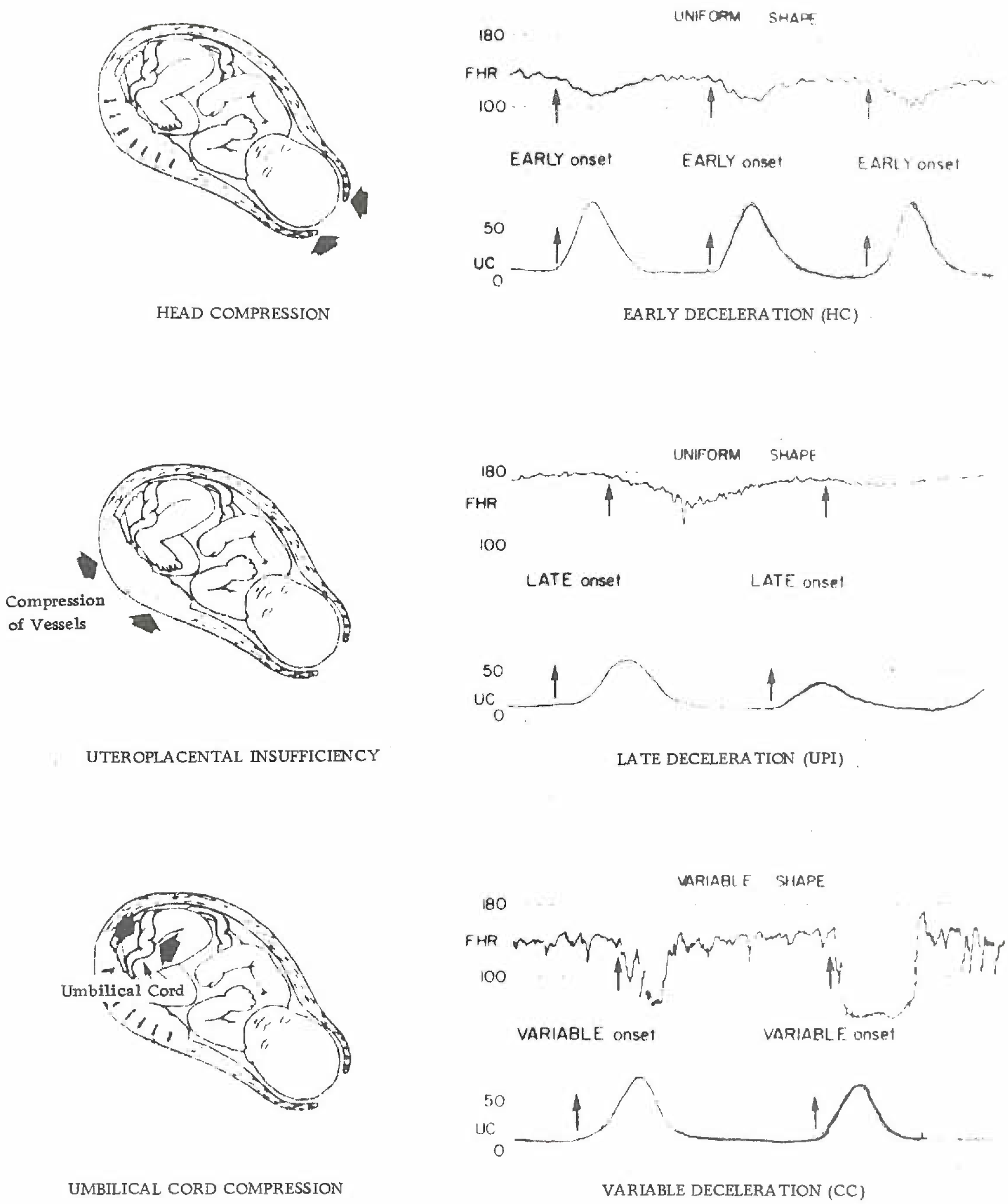

Figure 2. Three major types of fetal heart rate deceleration patterns. (From, Hon, E. <u>An Introduction to Fetal Heart Rate Monitoring</u>. Los Angeles: Postgraduate Division, University of Southern California, School of Medicine, 1973.

assessment is based on five objective parameters: color, heart rate, respiratory effort, reflex activity and muscle tone. A value of 0, 1 or 2 is given each sign and then totalled at one and five minute intervals (Table 1).

TABLE 1

Apgar Scoring System

Sign	Value 0	1	2
Heart Rate	Absent	$<$ 100/min	$>$ 100/min
Respiratory Effort	Absent	Weak, cry hypoventilation	Good, strong cry
Muscle Tone	Limp	Some flexion of extremities	Well-flexed extremities
Reflex Activity (Response to stimulation of feet)	No response	Some motion	Crying
Color	Blue, pale	Body pink, extremities blue	Completely pink

The majority of newborns score between 7 and 10 at one minute. The most common abnormalities of this group are color and respiratory effort. Those infants scoring 4 to 6 comprise the group that are characterized by normal heart rate and normal reflex irritability but demonstrate some cyanosis, irregular respirations, and poor muscle tone (Driscoll and James, 1976). The severely depressed infants score 0 to 3, usually scoring only on heart rate and reflex activity.

Serial Apgar scores of infants at 1, 2, 5 and 10 minutes are taken. The one minute score distinguishes the infant that requires immediate resuscitation. The five minute score correlates more closely with neonatal mortality and morbidity (Driscoll and James, 1976).

Prediction of fetal outcome from fetal heart rate patterns during labor has been supported by fetal studies on both animals and humans (Hon, 1975). Original research determining the etiology of fetal heart rate patterns has been directed at predicting the fetus in distress. Hon pioneered this work and developed the concept of fetal distress as follows:

> "If one accepts the assumption that before the fetus is irreversibly damaged it will first of all experience stress, then it follows that if stress is permitted to increase beyond fetal tolerance it will cause fetal distress. Unfortunately, in a given clinical situation, it is not possible to determine the precise point at which the margin of fetal reserve is exceeded and 'fetal stress' progresses to 'fetal distress' " (Hon, 1975, p. 2).

Hon further states, "it is important to recognize that, conceptually labor is a fetal stress test in which the fetus may be handicapped by maternal medical complications, analgesia, anesthesia, and hypotension" (p. 2).

The most commonly recognized mechanisms for fetal distress are umbilical cord compression and uteroplacental insufficiency.

Umbilical cord compression, associated with variable decelerations, is considered acute fetal distress. Most fetuses can withstand variable decelerations for 30-45 seconds. Thus, the duration and frequency of variable decelerations determine the effect on the fetus (Petrie and Pollak, 1976).

Uteroplacental insufficiency is caused by inadequate intravillous blood flow, which interrupts fetal oxygenation. This may be the result of excessive uterine activity and/or maternal hypotension. These two factors are acute in nature. Toxemia, chronic hypertension, Rh isoimmunization and diabetes mellitus may result in a chronic uteroplacental insufficiency. Late declerations, caused by uteroplacental insufficiency, have been associated with fetal and neonatal acidosis, neonatal depression and fetal death (Hon, 1975).

Regardless of the mechanisms of fetal distress, the underlying cause is fetal acidosis. This occurs in two steps. When the fetus is subjected to acute distress such as umbilical cord compression, there is a rapid build-up of carbon dioxide which causes a respiratory acidosis. If this condition persists the fetus becomes hypoxic. Inadequate fetal oxygenation forces the fetus to revert to anaerobic metabolism for energy production (Petrie and Pollak, 1976).

The fetus depends on the oxidation of glucose to produce energy for its metabolic needs. Aerobic metabolism of glucose is a much more efficient means for energy production, yielding 38 high-energy phosphate bonds. It is dependent on the presence of oxygen. In the overall sequence of energy producing reactions, anaerobic metabolism known as glycolysis, proceeds aerobic metabolism. In the presence of oxygen, lactic acid, the end product of glycolysis is normally not produced. It is reoxidized to pyruvic acid, the precursor of the citric acid cycle. Thirty of the total high energy phosphate bonds are produced in the citric acid cycle. Without oxygen, pyruvic acid is reduced to lactic acid using 6 high-energy phosphate bonds for the reaction. The net energy yield from anaerobic metabolism is 2 high-energy phosphate bonds plus an accumulation of lactic and pyruvic acids. The elevated levels of lactic acid result in an increase in hydrogen ion concentration and a decrease in buffer base which gives rise to a metabolic fetal acidosis (Hon and Khazin, 1968). Thus, lack of efficient placental exchange leads first to fetal respiratory acidosis and then to metabolic acidosis. Persistent hypoxia and acidosis may cause brain damage or death from asphyxia (Petrie and Pollak, 1976).

Acid-base assessment of the fetus at delivery may be used to determine the extent of fetal acidosis. Simply defined, fetal acidosis is an increase in hydrogen ion concentration in umbilical cord blood (Kaiser, 1960), and is quantified by the expression pH.

In 1909 Sorensen developed the pH scale for expressing hydrogen ion concentrations and defined the pH of a solution (Masoro and

Siegel, 1971) as the negative value of the logarithm of its hydrogen ion concentration:

$$pH = -\log (H^+)$$

At the same time Henderson described the relationship between acids and bases in the animal organism and developed the Henderson mass action equation. This states that the hydrogen ion concentration is proportional to the ratio of free carbonic acid to bicarbonate (Van Slyke, 1973). Hasselbalch, in 1910, developed a hydrogen electrode and measured the pH of the blood for the first time. In 1916 Hasselbach expressed the Henderson equation in logarithmic form, presently known as the Henderson-Hasselbach equation (Van Slyke, 1973):

$$pH = pk + \log \frac{(HCO_3^-)}{(H_2CO_3)}$$

Application of the concepts of acid-base to newborn infants was made in the 1920's. In 1928, Bell and his associates documented that fetal blood pH is lower than maternal blood pH (Kaiser, 1960). Unlike the adult female, the fetus maintains a blood pH between 7.25 and 7.35 during labor (Freeman, 1974). Introduction of the technique of fetal scalp blood sampling by Saling in 1961, allowed observation of fetal blood pH during labor. James (1973) reported in unpublished data, a drop in fetal pH during labor, 7.32 at 4 cm. dilation to 7.25 at complete dilation. Subsequent investigations (James, 1973) have demonstrated that fetal blood pH remains between 7.30 and 7.35 in labor. However, as labor advances into the second stage, the fetus develops a brief period of physiological acidemia due to expulsion of the infant through the vagina and changes in placental circulation. James (1973) in his work with puppies in 1958, concluded that the pH of umbilical cord blood is a better index of the duration of asphyxia than the oxygen levels. He asphyxiated newborn puppies delivered by cesarean section and collected serial umbilical cord blood pH from arterial umbilical catheters. It was found that oxygen levels fell from 90 percent to near zero in two and one-half minutes. The pH also dropped rapidly and continued to even after oxygen levels reached near zero.

Due to anareobic metabolism in the heart, all mammalian newborn hearts will continue to beat after oxygen levels are depleted. James observed the newborn puppy heart to beat 20 minutes after asphyxiation. Blood pH values were plotted against time giving a more accurate picture of the duration of asphyxia. Fetal acid-base status is, therefore, assessed by the umbilical cord blood pH value. As the pH value decreases, there is an increase in the hydrogen ion concentration, indicating the degree of acidosis.

As the techniques for predicting fetal distress and fetal acidosis have become more sophisticated, further investigations have correlated Apgar scores at birth, fetal heart rate patterns and fetal pH changes. James (1973) found that an infant's condition at birth, as evaluated by the Apgar scoring system, correlates well with his acid-base state. Infants with a mean pH of 7.27 had an Apgar score of seven or more while those infants with an Apgar of six or less had a mean pH of 7.22.

Prediction of Apgar scores based on the incidence of specific fetal heart rate patterns has been studied (Schifrin and Dame, 1972; Hon and Petrie, 1975). High Apgar scores at five minutes were accurately predicted from normal fetal heart rate patterns. Low Apgar scores predicted from abnormal fetal heart rate patterns, were less accurate. Bissonette (1975) examined the relationship between the fetal heart rate pattern in the first stage of labor and the one-minute Apgar score. This study reports five fetal heart rate patterns associated with Apgar scores of seven or greater. These patterns are: normal; uncomplicated baseline tachycardia; uncomplicated baseline bradycardia; accelerations; and early deceleration. Apgar scores of 6 or less were associated with late decelerations and variable decelerations with an abnormal baseline. A recent study (Chik, Sokol and Rosen, 1976) also using one-minute Apgar score and fetal heart rate patterns, reports 74% accuracy in classifying infants with high or low Apgar scores. Sixty per cent of the infants with low Apgar scores were not identified. This study recommends the use of multiple observation parameters for better prediction of fetal outcome.

Tejani, Mann and Bhakthavathsalan (1976) evaluated 20 cases to evaluate fetal outcome predictions. By using fetal blood pH along with fetal heart rate patterns and Apgar scores, fetal depression was predicted. In 88% of the depressed infants the umbilical blood pH was less than 7.20. This study substantiates prior investigations correlating Apgar scores, fetal heart patterns and fetal pH as indices of fetal outcome (Hon, Khazin and Paul, 1959). The use of these parameters is an accepted means of assessing fetal outcome.

Review of the Literature

The review of the literature on position in childbirth will be discussed in five sections:

1. The Cultural Evolution of Position in Childbirth
2. Position as a Nursing Intervention
3. The Effect of Maternal Position on Body Systems in the Pregnant State
4. The Effect of Maternal Position on Labor
5. The Effect of Maternal Position on the Fetus

Establishing the review of the literature in the above sections should give the reader a frame of reference for identifying the significance of position in childbirth.

The Cultural Evolution of Position in Childbirth

That women in the Western world labor and deliver on their backs remains the position dictated by medical mores. Much of current obstetrical practice is being examined for its validity, yet certain routines stand entrenched by tradition. One example is the dorsal position utilized for labor and the lithotomy position used for delivery. Recent research and current thinking are again reflected on the debated issue of position in labor and delivery.

Neither the upright nor the lateral position are new to childbirth practices. Historically, women delivered their babies by squatting on a birth stool. Louis XIV replaced the birth stool with a flat horizontal table so that he could watch his wives and mistresses giving birth. The court physician found this more convenient and gradually, all women of the court and peasant women throughout France emulated the royal fashion of lying down to give birth (Arms, 1975).

Throughout history, forty different positions for childbirth have been observed ("Position in Childbirth", 1966). In most non-European societies not influenced by Western medical practices, the women normally assume some sort of upright position. A study of the position of women during paturition in seventy-six non-European societies revealed four varieties of the upright position, 1) sitting, resting on the buttocks, 2) squatting, weight resting on the feet, 3) upright kneeling, weight on knees, 4) on feet, knees bent slightly or not at all. Of the seventy-six societies studied, sixty-two used an upright position for childbirth, nineteen assumed the sitting position, fifteen squatted; twenty-one kneeled; and five stood. It was also observed that parturients were rarely in an upright position without physical support. In thirty-two of the societies studied, the support was provided by the parturient's female relative. The conclusion from this study was that modern Western societies were exclusive in their use of the dorsal and lithotomy positions (Norall, Norall and Howard, 1961).

The common position assumed for childbirth in European countries is dorsal with the feet supported on foot rests. The left lateral position is also used with the uppermost leg of the parturient on the delivery attendant's shoulder (Atfield, 1966). There has also been a reported use of the prone position for labor in Australia (McAuliffe, 1964). Positions for childbirth are numerous and are based on customs and tradition.

Present day societies sophisticated by modern medical practices demand that the obstetrician or midwife have access to the perineum. Hence, modern positions evolved for two reasons. First, the dorsal, supine or recumbent position evolved to facilitate forceps application. Second, these positions transposed the squat to the horizontal plane (Blankfield, 1966). Haire (1972) after visiting numerous maternity hospitals throughout the world contends that the use of the dorsal and lithotomy positions in America is solely for convenience. She offers further explanation:

> "There is no question that the welfare of their patients has always been the deep concern of American physicians,

> nurse-midwives, and nurses. The unphysiologic practices which have become so much a part of American obstetric care--to the point where such practices have been generally accepted as normal accompaniments of birth--appear to have gradually built up as a result of social customs and cultural patterning" (p. 6).

Position as a Nursing Intervention

Rogers (1970) writes that "nursing aims to assist people in achieving their maximum health potential (p. 86)." She further states that "maintenance and promotion of health, prevention of disease, nursing diagnosis, intervention and rehabilitation encompass the scope of nursing's goals (p.88)." Bevis (1973) views nursing as a process; "its purpose is to promote optimum health through protective, nurtrative, and generative activities (p. 56)." In the practice of nursing, nursing's protective, nurtrative, and generative activities are based on principles and theories drawn from various disciplines. Patient positioning is such an activity.

Patient positioning is a nursing intervention based on the assessment of the comfort needs of the patient (Kozier and DuGas, 1967). Assessing patient needs is a nursing responsibility (Wiedenbach, 1964). Positioning also has a curative component whether it be for proper body alignment for traction or for facilitating tissue restoration in decubitus ulcers. In Bevis' terms positioning is a protective and nurtrative behavior.

However, positioning is not necessarily founded in scientific principles. A particular procedure may have approved helpful in the past but its continued use should be based on a scientific principle rather than experience alone (Tryon, 1966). Patient positioning in labor and delivery is no exception to this rule.

The objectives for the nursing care of the woman in labor are twofold: 1) To maintain the mother in the best possible state by nursing care that promote physiologic homeostasis, comfort and support, and 2) To maintain the fetus in the best possible state by promoting fetal homeostasis (Matousek, 1968). Positioning in labor and delivery as a comfort measure has been investigated (Tryon, 1966) and is recommended as such in nursing texts (Clark, 1976; Reeder, 1976). The controversy as to its effect on the outcome of the fetus continues to confuse any formation of an underlying scientific principle.

Based on the present status of the debate on position in childbirth, the candidate proposes to examine the effect of an upright lateral position during labor on the outcome of the fetus. Consider first, that which has been researched regarding the physiological effects of maternal position on pregnancy, labor and the fetus.

The Effect of Maternal Position on Body Systems in the Pregnant State

The stress of pregnancy alone alters physiological function in almost all body systems. The cardiovascular system functionally changes by increasing cardiac output, cardiac rate and by an increase in stroke volume (Bonica, 1969). Cardiac output rises early in pregnancy by about 45% above the non-pregnant state. This maximum is reached by about the 28th week and remains at about 6.0 liters / minute with a steady decline during the last month of gestation to 5.5 liters/minute. Heart rate increases 10-15% and stroke volume rises 15-25%. Stroke volume change results from an end-diastolic blood volume increase (Hytten, 1974).

The increased blood volume in pregnancy is reflected in the volume changes of plasma and red blood cells. Plasma volume increases 45% and red blood cell volume changes 20%. The overall blood volume rise is 40% or approximately 1.5 liters. Like the hemodynamics changes, volume change maximums are reached by the 28th day of pregnancy (Hytten, 1974).

Arterial blood pressure changes are minimal with a slight decrease in systolic and diastolic measures during the second trimester. However, total peripheral resistance decreases show a mirror image of the increase in cardiac output. Venous pressure changes during pregnancy are marked. Pressures in the veins of the arms are unchanged but pressures in the femoral and other leg veins are high (Hytten, 1974).

Quilligan and Tyler (1955) reported decreased systolic blood pressure changes of 15 mm Hg. and greater in pregnant women in supine position as compared to the lateral position. This study did not show a significant change in the cardiac output in either position. In contrast, further work by Vorys and Hanusek (1961) showed a significant decrease of cardiac output in the supine position and an increased cardiac output when the patient was changed to a lateral position. This phenomenon is partially explained by the weight of the gravid uterus being displaced from compressing the inferior vena cava. Supine hypotension syndrome, as this is known, does not develop instantaneously but depends on pooling of blood in the lower extremities and therefore a subsequent decrease in blood return to the heart and lungs. There is some evidence to suggest that this condition predisposes to premature separation of the placenta, endangering both mother and fetus (Bond, 1973). Maternal hypotension, and therefore reduced uterine blood flow, is also known to produce subnormal placental gas transfer (Bonica, 1969).

The effect of the supine position on maternal hemodynamic changes was advanced by studies done by Ueland and Hansen (1969). Cardiac output increased, heart rate decreased and stroke volume increased in pregnant women in early labor when changed from supine to lateral positions. Their work also suggests that not only the inferior vena cava is compressed but also that tha aorta is affected.

Renal changes in pregnancy are reflected by the glomerular filtration rate. The glomerular filtration rate measured by inulin clearance and reflected by creatinine clearance increases 50% during early pregnancy. Along with a glomerular filtration rate increase there are also decreased blood levels of creatinine, BUN and uric acid. Effective renal plasma flow has been shown to increase 25% (Hytten, 1974). Fluid and electrolyte changes are unclear at this time. There is some evidence to show that secretion and excretion of aldosterone increases suggesting increased retention of water and sodium.

The effects of maternal position on the urinary output and function in pregnancy has been investigated by Hendricks and Barnes (1955). They compared urine output in ten patients lying in the supine position and in the lateral position. Urine output increased 105% when the patients were positioned laterally. Bonica (1969) reports that the weight of the uterus compressing the inferior vena cava results in a slight decrease in renal blood flow and a decrease in the glomerular filtration rate.

There are minimal changes in the respiratory system during pregnancy. Tidal volume rises as pregnancy progresses. In the last half of pregnancy, there is a slight decrease in the expiratory reserve. Vital capacity, inspiratory reserve and inspiratory capacity remain the same. There is a slight decrease in residual volume. The respiratory rate changes little. Therefore, the pregnant woman increases ventilation by breathing deeper rather by more frequently

(Hytten, 1974).

Shortness of breath is a common complaint during pregnancy. This is probably due to the hormone, progesterone which is elevated during pregnancy, acting on the respiratory center and increasing the respiratory rate. Towards the end of pregnancy, the growing uterus pushes the diaphragm upward exaggerating the shortness of breath. The lateral position reduces the pressure of the uterus against the diaphragm (Bond, 1973).

The body systems discussed above are altered by position in pregnancy. Further changes are compounded by labor.

The Effect of Maternal Position on Labor

The research directed towards the effect of maternal position on labor has been sporadic. Williams (1952), studying normal uterine action in labor by internal tocography, observed that certain conditions predispose to normal uterine action, one of which is that a woman should avoid recumbency too early in labor. He documents this observation by submitting the tracing of a primigravida during spontaneous labor who when moved from a supine to a sitting position demonstrated a change in uterine contractility. In the sitting position the intensity of uterine contractions was greater and the frequency of contractions was less. Similar findings have been recently reported by Mitre (1972) and Lui (1974).

Bosch and associates (Mendez - Bauer, et al., 1976) in 1954 observed that uterine contractions in the dorsal position are more frequent and less intense than in the lateral position. Lorand and Pogany (Mundez - Bauer, et al., 1976) at about the same time concluded that uterine activity was not independent of maternal position.

Caldeyro-Barcia's (1960) pioneering work on the physiology of uterine contractility documented the effect of position on labor. By using intraamniotic pressure recordings, the women in this study were found to have uterine contractions of reduced intensity, contractions with greater frequency and to have increased uterine tonus when positioned dorsally. When the subjects were in a lateral position, uterine contractions increased in intensity and the frequency of contractions decreased. No difference was found between the right or left lateral position.

Caldeyro-Barcia (1960) also noted that the change in uterine contractility occurred immediately with a position change of dorsal to lateral and that it lasted until the position was changed again. In the lateral position there was more time for complete uterine relaxation, therefore re-establishment of uterine blood flow reduced by contractions. Contractions in the lateral position were more efficient for the progression of labor. It was also observed that this positional effect was greater in spontaneous labors than in those induced. The study did not show a difference of effects on the basis of parity of the subjects, status of the membranes or position of the fetus in utero.

Lui (1974) demonstrated that when an upright 30° position was assumed during labor that there was greater regularity of frequency in uterine contractions and the intensity of contractions was greater. The duration of the first and second stages of labor were examined. Among the women in an upright position, the first stage was 167.67 minutes compared to 253.40 minutes for the first stage in those women in a recumbent position. For the second stage, duration was 34.00 minutes, upright and 74.67 recumbent. All the women studied were primigravidas.

More recently Mendez-Bauer (1976) and his group have studied the effect of the standing position during labor. By means of internal fetal monitoring, twenty primigravidas were studied during spontaneous labor. The intensity of uterine contractions was greater in the standing position than in the supine position. Uterine activity, calculated by multiplying the intensity (mmHg.) by frequency (number of contractions/10 min.) was greater standing than in the supine position.

Duration of labor and cervical dilation were also studied by Mendez-Bauer (1976) and associates. The average duration of labor, 3 cm to 10 cm of cervical dilation, was 3 hr. 55 min. with 75% of the patients dilating 3 cm to 10 cm in less than 5 hours. Cervical dilation, dependent on uterine work, was evaluated by calculating uterine efficiency to dilate the cervix. Uterine efficiency was defined as the log of change in cervical dilation (cm) divided by the sum of the intensity of uterine contraction (montivideo units). It was found that uterine efficiency was greater in the standing position.

Comparing these results with studies reporting the average length of labor in primigravidas gives the data greater significance. Cibilis (1972) found an average duration of the first stage of labor of 6 hours 20 minutes. Niswander and Gordon (1972) in a larger study reported the first stage duration in primigravidas to be greater than 7 hours. Both studies used 3 cm to 10 cm cervical dilation as parameters for the first stage of labor. Clearly the effect of an upright position on the duration of labor is evident. Theoretically by reducing the time in labor, the stress produced by uterine contractions on the fetus may be lessened.

Theoretically, the upright position is believed to thrust the fundus of the uterus forward and therefore straighten out the longitudinal axis of the birth canal. Decent of the fetus in then encouraged by gravity (Chan, 1963). The presenting part presses on cervical nerve endings, stimulating stronger contractions (Whitely, 1975). Expulsion of the fetus powered by uterine contractions is facilitated by gravitational pull in the upright position. The recumbent position inhibits the mother's voluntary efforts to push her baby out spontaneously (Blankfield, 1966).

Increased intra-abdominal pressure aids in expulsion of the fetus. "The longer the pressure increase is sustained, the greater the use that is made of the period of uterine contraction (Blankfield, 1966, p. 667)." The rectus abdominis is the main muscle used for pushing in the second stage of labor. Considering basic principles of muscle action, fixation, synergism and gravity, these forces working together maximize the mother's pushing efforts and the strength of the uterine contractions. Muscles work best when at an optimum length. Elevating the mother during expulsion attempts, fixes the pelvis, the thorax and the spine. The anterior abdominal muscles are then free to exert their compressive force which increases intra-abdominal pressure. When during pushing the mother is recumbent, she is working against gravity (Blankfield, 1966).

The effectiveness of an upright position during the second stage of labor has been studied (Newton, 1956; Blankfield, 1966). Both studies concur with increased effectiveness of expulsion and also increased comfort for the woman when assuming an upright position. Newton (1956) further observed that women attempted to elevate themselves during contractions in the second stage of labor even without encouragement.

Ueland and Hansen (1969) evaluated maternal hemodynamic changes in labor under standardized postures. By changing maternal posture from supine to lateral in early labor, cardiac output increased 15.3%, heart rate decreased 7.6%, stroke volume increased 21.5%.

Supine hypotension syndrome, seen in late pregnancy was not observed in the lateral position. The lateral position alleviated supine hypotensive syndrome by relieving obstruction of the inferior vena cava, allowing pooled blood to return to the central circulation.

Another adverse effect of the supine position during labor has been observed. In 1955, Poseiro described a reduction of femoral arterial pressure during uterine contractions when the parturients were supine (Goodlin, 1971). This phenomenon, termed the Posiero effect has been related to maternal hypotension. Ten of 21 patients in a study by Goodlin (1971) showed brachial systolic pressures of 90 mm Hg or below. These pressures were relieved by positioning the mother laterally.

The literature supports the upright and the lateral positions during labor. Because the fetus is dependent upon the mother for a stable environment, the discussion of position effects is not complete without examining its effect on the fetus.

The Effect of Maternal Position on the Fetus

The unique maternal-fetal relationship makes fetal assessment important. Measures involving the mother can benefit or compromise the fetus (Matousek, 1968). Fetal oxygenation is dependent on the exchange of gases between himself, the mother and the placenta. Disruption of this balance jeopardizes the well-being of the fetus.

The maternal supine position has been shown to be unfavorable to the fetus, due to compression of the inferior vena cava and the aorta. Maternal hypotension observed in the supine position has been associated with fetal distress (Hon and Petrie, 1975). By indirect fetal monitoring, Spraden (1972) found fetal bradycardia and slight fetal arrythmia when the mother was in the supine position. Turning the mother to her side normalized the fetal heart rate. Variable decelerations have been associated with maternal supine hypotension (Hon, 1973). Cord compression also manifested clinically by variable decelerations may be alleviated by lateral position as well as alleviating maternal supine hypotension (Hon, 1973). This alters the anatomical relationship between the fetus, uterine wall, and the umbilical cord (Cohen and Rosen, 1976).

Goodlin (1971) recommends lateral position during labor. Seven of the 21 patients he studied in the supine position and who demonstrated the Poseiro effect, showed abnormal fetal heart rate tracings. Five of the seven infants had one-minute Apgar scores of below seven. Lateral position abolishes the Poseiro effect, Goodlin comments, "To keep parturients supine, unless they have nausea, upperextremity hypotension or demonstrate the Poseiro effect, is to ignore the possibility that uterine hypoperfusion can result from aortic obstruction, without other recognized maternal effects" (p. 701).

Fetal acid-base status has been shown to be effected by maternal position. Initially, Wood (1974) and associates demonstrated that speeding birth favorably affects cord blood pH probably by reducing fetal asphyxia. The group with shorter labors showed an average umbilical cord blood pH of 7.28; the group with normal length of labor had an average pH of 7.23. Parity, age of the mother and length of gestation showed no significant difference. Humphrey and Wood (1974) extending previous work, studied 40 normal parturients in the dorsal and left-tilt delivery positions. Left-tilt is a left lateral position. The dorsal position was associated with a time-related drop in fetal blood pH, the left-tilt was not.

Humphrey's study (1974) examined fetal capillary scalp blood at the onset of the second stage of labor, cord blood taken at delivery and two-minute Apgar scores. The patients who delivered within 30 minutes showed a significant drop in fetal blood pH ($p < 0.01$) and was related to the dorsal position. Those patients in the left-tilt position did not show a decline as time progressed ($p < 0.05$). No actual cord blood pH values were available in the published data. In the conclusion of this study, Humphrey related, "In the dorsal position the predicted change is -0.25 pH units over 30 minutes. Therefore, prolonged placement of the patient in the dorsal position appears inadvisable" (p. 602).

Purpose of the Study

In light of the above discussion on the effect of position on pregnancy, labor, delivery and the fetus, it seems reasonable to assume that an upright, lateral maternal position will have a positive effect on the fetus. It was the purpose of this study to determine the effect of a maternal upright, lateral position on fetal outcome. Fetal outcome was measured by newborn Apgar scores, changes in the fetal heart rate pattern, and fetal acid-base status. Women assuming the upright, lateral position during labor were compared to women who assumed no directed position.

Operational Definitions

Upright Lateral Position

The upright lateral position refers to that position assumed by a parturient lying in a bed, the head of the bed elevated to a 30° angle and the parturient positioned on either side.

Acid-Base Status

The acid-base status is an indicator of fetal well being measured by the pH of blood taken from the umbilical artery at the time of delivery. The normal values are between 7.25 and 7.35.

Newborn Apgar Score

The newborn Apgar score is a quantitative index evaluating the newborn's condition at birth, assessing heart rate, respiratory effort, muscle tone, reflex activity, and color. A score of seven to ten is a normal Apgar score, a score of six to four represents moderately depressed Apgar score, and a score of three to zero is a marked depressed Apgar score.

Fetal Heart Rate Pattern

The fetal heart pattern obtained by continuous electronic fetal monitoring of the fetal heart rate depicts benign and pathological affects on the fetus. Table 2 lists the criteria for classification of fetal heart rate patterns.

TABLE 2

Criteria for Fetal Heart Rate Classification*

FHR pattern	Criteria
Normal	Rate in the range 120 to 160 beats per minute; no change in rate throughout uterine contractions; beat-to-beat variation greater than five beats per minute.
Uncomplicated baseline tachycardia	FHR between contractions of 160 or more beats per minute; no change in rate throughout contraction; beat-to-beat variation greater than five beats per minute.
Uncomplicated baseline bradycardia	FHR between contractions of 120 or less beats per minute; no change in rate throughout contraction; beat-to-beat variation greater than five beats per minute.
Uncomplicated loss of beat-to-beat variation	Variation in FHR of five beats or less per minute; rate in the range 120 to 160 beats per minute, no change in rate throughout contraction.
Complicated loss of beat-to-beat variation	Variation in FHR of five beats or less per minute; rate of 160 or more or rate of 120 or less beats per minute.
Acceleration	FHR increases above the baseline rate during uterine contraction; rate in the range 120 to 160; beat-to-beat variation greater than five beats per minute.
Early deceleration	FHR decreases below baseline as the intrauterine pressure is rising and returns to baseline before the end of the contraction; amplitude of the deceleration does not exceed 40 beats per minute.
Late deceleration	FHR decelerations characterized by a lag time of at least 18 seconds; failure of FHR to return to baseline well after the end of the contraction; amplitude of the deceleration rarely exceeds 30 beats per minute.
Variable deceleration with normal baseline	FHR deceleration is variable in onset relative to the uterine contraction and variable in shape; FHR deceleration is abrupt with sharp return to baseline; baseline rate between 120 and 160 beats per minute; beat-to-beat variability greater than five beats per minute.
Variable deceleration with abnormal baseline	Baseline rate 160 or more, or 120 or less beats per minute; variation in FHR of five beats or less per minute.

*From J. M. Bissonette. Relationship Between Continuous Fetal Heart Rate Patterns and Apgar Score in the Newborn. The British Journal of Obstetrics and Gynecology. 1975, 82, 24.

Hypotheses

1. Infants born to mothers who assume a 30° upright lateral position during labor and delivery will have higher one and five minute Apgar scores than those born to mothers who do not assume this position.
2. Infants born to mothers who assume a 30° upright lateral position during labor and delivery will have higher umbilical cord blood pH values than those born to mothers who do not assume this position.
3. Infants born to mothers who assume a 30° upright lateral position during labor and delivery will have fewer abnormal fetal heart patterns during labor than those born to mothers who do not assume this position.

CHAPTER II

METHODOLOGY

Subjects

Over a two month period, forty intrapartal women admitted to the University of Oregon Health Sciences Center, University Hospital North, Labor and Delivery Unit for delivery of their infants were selected for this study. Subjects were part of the normal intrapartum patient population. The following selection criteria were posted in the labor and delivery unit. When patients met these criteria, the candidate was notified by the nursing staff.

Selection Criteria:

Age - 18-35 years.
Normal pelvic structure by clinical exam.
Single vertex presentation.
No indication of cephalopelvic disporportion, biophysical pathology or psychiatric disorder.
38-42 weeks of gestation.
Spontaneous onset of labor.
Anticipated local anesthesia for delivery.

Selection criteria were based on those factors that would deem possible subjects normal rather than high-risk. Each of these factors have also been shown to influence the outcome of labor (Pritchard and MacDonald, 1976). An additional criterion was that only those infants weighing between 2500 grams and 4000 grams were to be studied. Infants weighing less than or greater than these values often have a incidence of respiratory depression in the first minutes of life (Lui, 1974). The selection criteria were used in an attempt to control for intervening variables other than the effect of maternal position during labor.

Twenty women were assigned to the experimental group and twenty to the control group. The candidate had no contact with the subjects prior to their admission to the Labor and Delivery unit. The nursing staff cognizant of the selection criteria for the study, notified the candidate when a potential subject was admitted. After the subject was screened according to the selection criteria, the purpose and procedure of the study was explained. The subjects were assured that the position change and the umbilical cord blood sample were the only variations in their routine care. The subjects then agreed to participate by signing an informed consent. These subjects were then designated the experimental group.

Women who fit the above outlined criteria were selected for the control group from an on-going study investigating fetal heart rate patterns (Schrinsky, Personal Communications, 1977). This study also uses Apgar scores, umbilical cord blood pH and fetal heart rate patterns as parameters for measuring fetal outcome. The candidate also collected the data for this study. This assured consistency in techniques of data collection. The age and parity of each possible subject was written on a card. A list of the age and parity of the experimental subjects was prepared. All possible control subjects were grouped accordingly. Then the groupings were shuffled and one subject was randomly picked from each group of cards. This was done to provide homogeneous matching of the control and experimental groups. All subjects in the control group delivered their infants in the same institution in a coincident time period as the experimental group.

Data Collecting Instruments

All subjects were continuously monitored with commercially available fetal monitors, Corometric Fetal Monitor models 101B and 111, during the first and second stages of labor. Either the internal pressure catheter or the external tocotransducer was used to measure uterine contractions. The internal fetal electrode attached to the presenting part was used to measure the fetal heart rate.

The Apgar score was recorded by the circulating nurse present at the delivery to control for the confounding variable effect of the candidate's involvement with the outcome of the labor and of the fetus. Apgar scores were recorded at one and five minute intervals.

Immediately after delivery of the infant, a segment of the umbilical cord still attached to the placenta was isolated between vascular clamps and placed on ice. One cc of blood was withdrawn from an umbilical artery into a plastic heparinized syringe and then sent to the laboratory for pH determination. Blood was not taken from the infant. Blood pH values were determined by a Corning, pH/Blood Gas machine, no. 165.

Design and Data Collection Procedure

The design for this study was prospective and experimental. The independent variable was the upright, lateral position and the dependent variable was fetal outcome. The design can be considered the Posttest-Only Control Group design (Campbell and Stanley, 1963):

$$\begin{array}{ccc} R & x & O_1 \\ R & & O_2 \end{array}$$

Subjects were admitted to the study when cervical dilatation reached 4 cm. This is the end of the latent phase and the beginning of the active phase of the first stage of labor. Uterine contractions have become strong and regular at this point, thus, subjecting the fetus to the stress of labor. The fetal monitor was also applied at this time.

Subjects in the experimental group were placed in a lateral position on either side in a bed that was elevated to 30°. The angle of the bed was measured by placing a protractor level with the unelevated portion of the bed and the head of the bed elevated to the 30° mark on the protractor. The subjects remained in this position throughout the first stage of labor.

During the second stage of labor the subjects remained in a 30° upright position. A wooden wedge was placed under the head of the delivery table to allow it to be raised to a 30° angle. This position change is the only difference from the routine procedures used.

The candidate was present for each experiment to insure consistency of technique in the data collection procedure. Excluding instruction of the patient to assume the upright lateral position, no other direct nursing care was given by the candidate. The umbilical cord blood sample was collected by the candidate.

The control group received the same obstetrical nursing and medical care as the experimental group with the exception of the position intervention. All subjects were continually monitored with the same fetal monitors. Apgar scores were recorded and umbilical cord blood samples were collected in the same manner as described for the experimental group.

Analysis of Data

Following the collection of data, the strips of fetal heart rates were interpreted by the candidate for identification of fetal heart rate patterns. One pattern was chosen per stage of labor. This was accomplished by designating that pattern which appeared predominately throughout each stage of labor. The strips were re-read by non-partisan observers in order to confirm the presence of the various fetal heart rate patterns. Two physicians, skilled at interpreting fetal heart rate patterns, were the observers for this study. The fetal heart rate patterns identified were then classified as either normal or abnormal. Patterns considered abnormal were complicated loss of beat-to-beat variation, late decelerations and variable decelerations with abnormal baseline (Beard, 1971; Bissonette, 1975). The incidence of normal and abnormal fetal heart rate patterns in the control and experimental groups were then contrasted by using the Chi Square. An Alpha level of 0.05 was used.

Means and standard deviations were calculated for the Apgar scores and cord blood pH values of both the control and experimental group. The student's t-test for unpaired samples was used to determine differences between the means at a probability level of 0.01.

All computations were done either by computer or desk calculator.

CHAPTER III

RESULTS

Characteristics of the Study Population

The study population consisted of forty intrapartal women. Twenty-two primigravidas and eighteen multigravidas were studied. Separated into two groups, the control and experimental groups, the subjects were comparable in age, parity and the incidence of umbilical cord around the neck and of meconium staining amniotic fluid. (See Appendix B, Raw Data.) The mean age of the control group was 23.2 years, standard deviation $\pm$ 3.2 years, and ranged from 20 to 30 years of age. The experimental group ranged in age from 20 to 31 years, with a mean age of 23.8 years and a standard deviation of $\pm$ 3.6 years.

There were eleven primigravidas and nine multigravidas in both the control and the experimental groups. Cord around the neck appeared five times in the control group compared to four times in the experimental group. Two of the subjects in the control group had meconium stained amniotic fluid compared to one in the experimental group. All subjects had vertex presentations with the exception of one who had a breech presentation. The breech presentation was undiagnosed until a few minutes before delivery.

Length of Labor

The length of labor was measured by the number of hours cervical dilatation progressed from 4 cm. to delivery of the infant. For statistical purposes the minutes were converted to decimals of hours. Ranging in hours from 1.26 to 8.93, the control group's mean number of hours in labor was 3.69 with a standard deviation of ±2.08 hours. The mean number of hours in labor for the experimental group was 4.05, with a standard deviation of ±2.02. The length of labor for the experimental group ranged from 1.0 to 8.0 hours. There was no significant difference in the length of labor between the control group and the experimental group. (See Appendix B.)

Apgar Scores

Of the twenty infants in the control group, eighteen had one-minute Apgar scores of seven or greater (normal) and two infants had scores of four to six (moderately depressed). In the experimental group, all twenty infants had one-minute Apgar scores of seven or greater. All forty infants studied scored eight or greater on the five-minute Apgar score. (See Appendix B.)

The mean Apgar scores of the control group were one-minute, 8.1, standard deviation ± 1.2, and five-minute, 9.2, standard deviation ± 0.6. The mean Apgar scores of the experimental group were one-minute 8.2, standard deviation ± 0.7, and five-minute 9.3, standard deviation ± 0.6. Although the incidence of moderate depression at one-minute was 10% in the control group, there was no significant difference between the control and experimental groups for either one or five-minute Apgar scores. (See Table 3.)

TABLE 3

Mean One and Five Minute Apgar Score for the Control and Upright Lateral Groups

Group	N	$\bar{X}$ one-minute Apgar score	SD	$\bar{X}$ five-minute Apgar score	SD
Control	20	8.1	± 1.2	9.2	± 0.6
Upright, Lateral	20	8.2	± 0.7	9.3	± 0.6

Fetal Acid-Base Status

The umbilical cord blood pH values collected immediately after delivery of the infant were used to determine fetal acid-base status. The mean pH values for the control and experimental groups were calculated. (See Appendix B.) A mean pH of 7.24 with a standard deviation of ± .08 was found for the control group while the mean pH for the experimental group was 7.30, standard deviation ± .05. A significant difference was found between pH values of the control group and of the experimental group, t - values = 2.809, $p < 0.01$.

Nine of the infants in the control group had pH values less than 7.25 as compared to two in the experimental group. (See Table 4).

TABLE 4

Mean Umbilical Cord Blood pH Values and Incidence of pH Values Less Than 7.25 in the Control and Upright, Lateral Groups

Group	N	$\overline{X}$pH	SD	% < 7.25
Control	20	7.24	±.08	45%
Upright, Lateral	20	7.30	±.05	10%

($t = 2.809$, $p < 0.01$)

Fetal Heart Rate Patterns

The incidence of fetal heart rate (FHR) patterns in the control group were compared to those patterns identified in the experimental group. A total of eighty patterns were observed in both groups. Of the eighty patterns examined, sixty-eight (85%) were considered normal and twelve (15%) were abnormal. The distribution of normal and abnormal FHR patterns in the control group was thirty-one (77.5%) normal FHR patterns and nine (22.5%) abnormal while in the experimental group thirty-seven (92.5%) were normal and two (7.5%) FHR patterns were abnormal. No significance could be demonstrated between the two groups. (See Table 5 and Table 6.)

Comparing the incidence of FRH patterns in the first stage of labor (I), revealed two (10%) abnormal FHR patterns in the control group and one (5%) in the experimental. The predominance of abnormal FHR patterns in the control group appeared in the second stage of labor (II). There were seven such FHR patterns. Of the seven FHR patterns, six were variable decelerations with abnormal baselines. Two abnormal FHR patterns were seen in the experimental group during the second stage of labor. Again no significant differences could be shown between the control group and the experimental group. (See Table 5 and Table 6.)

TABLE 5

Relation of FHR Pattern and Stage of Labor between the Control and Upright, Lateral Groups

Stage of Labor	FHR Pattern	Control		Upright, Lateral		χ^2	p
		No.	%	No.	%		
I	Normal	18	90	19	95		
	Abnormal	2	10	1	5	0.35	N.S.
II	Normal	13	65	18	90		
	Abnormal	7	35	2	10	1.54	N.S.
I & II	Normal	31	77.5	37	92.5		
	Abnormal	9	22.5	3	7.5	3.53	N.S.

The most frequently identified abnormal FHR pattern in both groups was variable deceleration with an abnormal baseline. There were six such patterns in the control groups comprising 66% of the

TABLE 6

Distribution of Dominant FHR Patterns in the Control and Upright, Lateral Groups: First and Second Stages of Labor

	I (N=40)		II (N=40)	
	Control	Upright, Lateral	Control	Upright, Lateral
Normal	9	8	0	7
Uncomplicated baseline tachycardia	0	0	0	0
Uncomplicated baseline bradycardia	1	2	4	2
Uncomplicated loss of beat-to-beat variation	0	1	0	0
Complicated loss of beat-to-beat variation*	0	0	0	0
Accleration	0	4	0	0
Early deceleration	2	0	3	0
Late deceleration*	2	0	1	0
Variable deceleration with normal baseline	5	2	7	9
Variable deceleration with abnormal baseline*	0	1	6	2

* Considered abnormal FHR patterns.

abnormal patterns seen in this group. All three (100%) of the abnormal FHR patterns in the experimental group were variable decelerations with abnormal baseline. (See Table 6.)

CHAPTER IV

DISCUSSION

Results of this study support the second hypothesis and thus demonstrate a statistically significant difference in the acid-base status of the infants born to those mothers studied who had assumed an upright, lateral position during labor. The main difference between the two groups studied was the upright lateral position. Bias in measurement of the pH values used is discounted because of lab-oratory analyzing the cord blood samples was unaware of the study and has considerable experience in the pH measurement technique for research purposes.

The mean pH value of the control group, 7.24, is lower than the normal values accepted for umbilical cord blood samples, pH 7.25 - 7.35 (Freeman, 1974). Nine samples measured less than the nor-mal 7.25. This finding is supportive of results reported by Humphrey, Chang and Wood (1974). Their work associated a decrease in fetal pH with a maternal dorsal position in labor. It is also interesting to note that of the nine low pH values, eight had values less than 7.20. Hon, Khazin, and Paul (1969) use a pH value of 7.20 as an indica-tion of fetal acidosis and asphyxia. Possible explanations for this may be that the physiologic acidosis reported by James (1976) may in fact be position related.

The first hypothesis, that there would be a difference in Apgar scores, was not supported by this study. However these findings are in support of previous work. Lui (1974) reported no difference in Apgar scores of infants born to mothers in an upright position. In contrast, Goodlin (1971) observed that 23% of the women studied that were left in a supine position had infants with Apgar scores of less than 7. Although the difference between the control and experimental group Apgar scores was not statistically significant, two of the infants born to mothers who did not assume the upright, lateral position had one-minute Apgar scores of five and six. These one-minute scores are suggestive of moderate neonatal depression at birth and appear to be a reflection of the intrauterine condition (Bissonette, 1975). These infants also had cord pH values of 7.19 and 7.17, respectively. In light of the lower pH values seen in the control group and the two instances of lower Apgar scores, this trend may be further elucidated by a larger study population.

The third hypothesis, that there would be fewer abnormal fetal heart rate patterns in the experimental group was not supported by this study. However, the incidence of normal and abnormal fetal rate patterns in the control group coincides with the incidence found in previous studies (Beard, Filshie, Knight and Roberts, 1971; Bissonette 1975). The incidence of normal and abnormal fetal heart rate patterns in the experimental group was less than that of previous reports. The difference between the two groups was not statistically different.

An interesting finding of this study was that there was no difference in the length of labor between the two groups studied. This finding is in contrast to the decreased length of labor in an upright position reported by Lui (1974). Mendez-Bauer, Arroyo and Zamarriego (1976) also observed a reduction in the length of labor in a standing position. Both groups in the present study did have below average lengths of labors but statistical difference between the two groups could not be demonstrated.

Attempts at measuring the comfort of a particular position in labor have been rather subjective but have suggested that a position other than recumbent may be more comfortable (Mendez-Bauer 1975, 1976). Following delivery of the first few subjects in the upright position, the subjects were asked if they wanted the head of the delivery table lowered. Twelve (60%) of the subjects responded that they did not want the delivery table lowered and volunteered that the upright position was more comfortable for them.

The nursing staff reaction to use of the upright lateral position was mixed at the onset of the study. However, towards the end of the study, the nurses were using the upright, lateral position in their care of first stage labor patients independent of this study. They also were using the wedge under the delivery table to elevate patients to an upright position for delivery.

The candidate noted that mothers in the upright position for delivery were better able to hold and examine their infants after delivery and during the time they remained in the delivery room for episiotomy repair. This encouraged the nursing staff to leave the infant with the mother longer since her ability to hold the infant was less precarious than in the dorsal or recumbent position. The upright position in the delivery room also provided a more comfortable position for mothers to attempt breast feeding for the first time.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Traditional childbirth positioning in the United States has been shown physiologically and anatomically to be impractical, and yet the practice of women laboring and delivering on their backs remains the predominant position used in this country. Childbirth positions appear to be culturally developed, and in some instances dictated strictly by custom. In the United States, the custom of recumbent childbirth has arisen for convenience.

The majority of research previously reported has examined the effect of position on pregnancy, labor and delivery. Only two studies to date, (Goodlin, 1971; Lui, 1974), have examined the effect of maternal position during labor on fetal outcome. This study has attempted to expand these studies and provide information regarding the effect of maternal position during parturition on infants.

Within this study sample there is a definite relationship between maternal position during labor and fetal outcome. Although infants were not born depressed, a large portion (45%) of the control group were born with pH blood values indicating that they had been subjected to an acidotic state in utero. Infants born to mothers in the upright lateral group did not show this trend towards fetal acidosis. Apgar scores, although valuable, did not contribute new information to the original problem.

Further study of the effect of maternal position during the first and second stages of labor on the fetal heart rate pattern is indicated. The trend identified in this study was that an upright, lateral maternal position may result in fewer abnormal fetal heart rate patterns. The incidence of abnormal patterns in the control group was comparable to the incidence expected from other studies (Beard, Filshie, Knight and Roberts, 1971; Bissonette, 1975). However, the incidence of abnormal patterns was less in the upright, lateral group than that reported in large study populations.

Position as a nursing intervention for the labor patient appears to have wider implications beyond the physiologic basis for the mother and the infant. This study suggests that the upright, lateral position is more comfortable for the patient and may provide greater opportunity for initial maternal infant bonding. Actual documentation of these effects as well as expanded research into the area of fetal outcome as related to maternal position is needed.

Conclusions

The findings of this study indicate that maternal position during labor has an influence over fetal outcome. The measurable differences in the cord blood pH values suggest that in this study population, the upright, lateral maternal position during labor is advantageous to the acid-base status of the fetus. It is unclear how this is accomplished. The incidence of abnormal fetal heart rate patterns in the upright, lateral position imply that the mechanism may be related to reducing the stress of labor upon the fetus. This may be accomplished by either encouraging adequate placental perfusion of oxygen, reducing cord compression or reducing pressure on the maternal inferior vena cava. In comparing the incidence of abnormal fetal heart rate patterns in the control group to the experimental, the most frequently identified pattern was variable deceleration with an abnormal baseline. Based on previous research (Hon, 1975) this suggests that the mechanism for alleviating this fetal heart rate pattern may be reducing cord compression or reducing pressure on the maternal inferior vena cava. The upright, lateral position appears to perform the function of reducing stress of labor to the fetus via these mechanisms.

This study contributes a more reliable method of assessing fetal outcome when examining the effect of maternal position on the fetus. Without use of the three parameters defined, Apgar scores, acid-base status of the fetus and fetal heart rate patterns, results would have been inconclusive. On the basis of the results found in this study, there appears to be a trend worth examining further.

Unexpected nursing implications of maternal position during labor and delivery beyond the physiologic realm have surfaced. These were: 1) maternal comfort, and 2) the opportunity to further maternal-infant bonding. Further study of these implications is needed.

Maternal position during labor determined by the mother's comfort may be in fact more advantageous for both her and her baby. Thus, the comfort component of maternal position also needs additional investigation.

Recommendations

Replication of the present study with larger samples is needed to validate and reinforce the results of this study. The relationship between length of labor and maternal position need to be further investigated. Nursing implications of positioning labor patients need to be further identified and examined.

REFERENCES

Arms, S. Immaculate Deception. San Francisco: Houghton Miflin, 1975.

Atfield, M.E. Positions for Labour and Delivery. Nursing Times, 1966, 62, 1180-1182.

Arroyo, J., Mendez A., and Garcia-Ramos, C. La Posicion de Pie Durante El Trabajo del Parto Espontaneo. I. Efectos Sobre Contractilidad Uterina, Dolory Duracion del Parto. Clinica Investigacions de Gynecologica Obstectrica, 1974, 1, 221-229.

Barcia-Caldeyro, R. Effect of Position Changes on the Intensity and Frequency of Uterine Contractions. American Journal of Obstetrics and Gynecology, 1960, 80, 284-290.

Beard, R., Filshie, G., Knight, C. and Roberts, G. The Significance of Changes in the Continuous Fetal Heart Rate in the First Stage of Labour. Journal of Obstetrics and Gynecology of the British Commonwealth, 1971, 78, 865.

Bevis, E. Curriculum Building in Nursing: A Process. Saint Louis: C.V. Mosby, 1973.

Bieniarz, Y., Yoshida, T., Romero-Salinas, G., Curuchet, E., Caldeyro-Barcia, R., and Crotlogini, J. Aortocaval Compression by the Uterus in Late Human Pregnancy. American Journal of Obstetrics and Gynecology, 1969, 103, 19-31.

Bissonette, J. Relationship Between Continuous Fetal Heart Rate Patterns and Apgar Score in the Newborn. Journal of Obstetrics and Gynecology of the British Commonwealth, 1975, 82, 24-29.

Blankfield. The Optimum Position for Childbirth. The Medical Journal of Australia, 1965, 2, 666-673.

Blechner, J. Fetal-Acid Base Homeostasis. Clinical Obstetrics and Gynecology, 1970, 13, 621-637.

Bond, S. Re-evaluating Positions for Labor - Lateral vs. Supine. Journal of Obstetrics, Gynecology and Neonatal Nursing, 1973, 2, 29-31.

Bond, S. Re-evaluating Positions for Labor - Lateral vs. Supine. Journal of Obstetrics, Gynecology and Neonatal Nursing, 1973, 2, 29-31.

Bonica, J. Principles and Practice of Obstetric Analgesia and Anesthesia. Philadelphia: F. A. Davis Company, 1969.

Bruce, N. and Abdul-Karim, R. Mechanisms Controlling Maternal Placental Circulation. Clinical Obstetrics and Gynecology, 1974, 17, 135-151.

Campbell, D. and Stanley, J. Experimental and Quasi-Experimental Designs for Research. Chicago: Rand McNally, 1963.

Chan, D. Positions in Labour. British Medical Journal, 1963, 5323, 100-102.

Chang, A. and Wood, C. Fetal Acid-Base Balance I. Interdependence of Maternal and Fetal pCO_2 and Bicarbonate Concentration. American Journal of Obstetrics and Gynecology, 1976, 125, 61-64.

Chik, L., Sokal, R., and Rosen, M. Prediction of the One-minute Apgar Score from Fetal Heart Rate Data. Obstetrics and Gynecology, 1976, 48, 452-455.

Cibilis, L. Enhancement and Induction of Labor. Risks in the Practice of Modern Obstetrics. St. Louis: C.V. Mosby, 1972.

Clark, A. and Affonso, D. Childbearing: A Nursing Perspective. Philadelphia: F.A. Davis, 1976.

Cohen, H. Biochemical Monitoring by Fetal Blood Sampling. Clinical Anesthesia, 1971, 10, 72-80.

Cohen, W. and Rosen, R. Recognition and Treatment of Fetal Distress During Labor. Journal of Obstetrics, Gynecology and Neonatal Nursing, (Supplement), 1976, 5, 565-605.

Driscoll, J. and James, S. Practical Aspects of Evaluation and Resuscitation of the Newborn. In R. Winters (ed.) The Body Fluids in Pediatrics: Medical, Surgical and Neonatal Disorders of Acid-Base Status, Hydration, and Oxygenation. Boston: Little Brown, 1973.

Fitzhugh, M. and Newton, M. Muscle Action During Childbirth. Physical Therapy Review, 1956, 36, 805- 809.

Freeman, R. Intrapartum Fetal Evaluation. Clinical Obstetrics and Gynecology, 1974, 17, 83-94.

Goodlin, R. Importance of the Lateral Position During Labor. Obstetrics and Gynecology, 1971, 37, 698-701.

Haire, D. The Cultural Warping of Childbirth. International Childbirth Education Association News, 1972, 3-35.

Hansen, J. and Ueland, K. Maternal Cardiovascular Dynamics During Pregnancy and Parturition. Clinical Anesthesia, 1971, 10, 22-36.

Hendricks, C. and Barnes, A. Effect of Supine Position on Urinary Output in Pregnancy. American Journal of Obstetrics and Gynecology, 1955, 69, 1225-1232.

Hon, E. An Introduction to Fetal Heart Rate Monitoring. Los Angeles: Postgraduate Division, USC, School of Medicine, 1973.

Hon, E. and Khazin, A. Biochemical Studies of the Fetus I. The Fetal pH-measuring System. Obstetrics and Gynecology, 1969, 33, 219-236.

Hon, E. Khazin, A. and Paul, R. Biochemical Studies of the Fetus II. Fetal pH and Apgar Scores. Obstetrics and Gynecology, 1969, 33, 237.

Hon, E. and Petrie, R. Clinical Values of Fetal Heart Rate Monitoring. Clinical Obstetrics and Gynecology, 1975, 18, 1-23.

Humphrey, M., Chang, A., Wood, E., Morgan, S., and Hounslow, D. A Decrease in Fetal pH During the Second Stage of Labor. Journal of Obstetrics and Gynecology of the British Commonwealth, 1974, 81, 600-602.

Hytten, F. and Leitch, I. The Physiology of Pregnancy. Philadelphia: F. A. Davis, 1974.

James, L. Acid-Base Changes in the Perinatal Period. In R. Winters (Ed.), The Body Fluids in Pediatrics: Medical, Surgical and Neonatal Disorders of Acid-Base Status, Hydration and Oxygenation. Boston: Little, Brown, 1973.

Kaiser, I. The Significance of Fetal Acidosis. American Journal of Obstetrics and Gynecology, 1960, 77, 573-584.

Kozier, B. and DuGas, W. Fundamentals of Patient Care. Philadelphia: W. B. Saunders, 1967.

Lui, Y. Effect of an Upright Position During Labor, American Journal of Nursing, 1974, 74, 2202-2205.

Lowensohn, R. Instrumentation for Fetal Heart Rate Monitoring. Journal of Obstetrics, Gynecology and Neonatal Nursing, (Supplement), 1976, 5, 75-105.

Martin, C. and Gingerich B. Factors Affecting the Fetal Heart Rate: Genesis of Fetal Heart Rate Patterns. Journal of Obstetrics, Gynecology and Neonatal Nursing, (Supplement), 1976, 5, 305-405.

Masoro, E. and Siegel, P. Acid-Base Regulation: It's Physiology and Pathophysiology. Philadelphia: W. B. Saunders, 1971.

Matousek, I. Fetal Nursing During Labor. Nursing Clinics of North America, 1968, 3, 307-314.

McAuliffe, P. The Prone Position in Obstetrics. The Medical Journal of Australia, 1964, 2, 182-183.

Mendez-Bauer, C., Arroyo, J., and Zamarriego, J. Maternal Standing Position in First Stage of Labor. In Searpelli and Cosmmi (Eds.), Reviews in Perinatal Medicine. Baltimore: University Park Press, 1976.

Mendez-Bauer, C., Arroyo, J., Garcia-Ramos, C., Lavilla, M., Tequierdo, F., Villaelizaga, I., and Zamarriego, J. Effects of Standing Position on Spontaneous Uterine Contractility and Other Aspects of Labor. Journal of Perinatal Medicine, 1975, 3, 89-99.

Mitre, I. The Influence of Maternal Position on Duration of the Active Phase of Labor. Internal Journal of Obstetrics and Gynecology, 1974, 12, 181-188.

Naroll, F., Naroll, R. and Howard, F. Position of Women in Childbirth. American Journal of Obstetrics and Gynecology, 1961, 82, 943-954.

Newton, N. and Newton, M. The Propped Position for the Second Stage of Labor. Obstetrics and Gynecology, 1960, 15, 28-34.

Niswander, K. and Gordon, M. The Women and Their Pregnancies. Philadelphia: Saunders, 1972.

Paul, R. and Hon, E. Clinical Fetal Monitoring V. Effect on Perinatal Outcome. American Journal of Obstetrics and Gynecology, 1974, 118, 529-533.

Petrie, R. and Pollak, K. Intrapartum Fetal Biochemical Monitoring by Fetal Blood Sampling. Journal of Obstetric, Gynecologic and Neonatal Nursing, (Supplement), 1976, 5, 525-555.

Position in Childbirth. British Medical Journal, 1966, 5479, 62-63.

Pritchard, J. and MacDonald, P. Williams Obstetrics (15th Ed.) New York: Appleton-Century-Crafts, 1976.

Quilligan, E. and Tyler, C. Postural Effects on the Cardiovascular Status in Pregnancy: A Comparison of the Lateral and Supine Postures. American Journal of Obstetrics and Gynecology, 1959, 78, 465-471.

Reeder, S., Mastroianni, L., Martin, L. and Fitzpatrick, E. Maternity Nursing. New York: J. B. Lippincott, 1976.

Rogers, M. An Introduction to the Theoretical Basis of Nursing. Philadelphia: F.A. Davis, 1970.

Schifrin, B. and Dame, L. Fetal Heart Rate Patterns: Prediction of Apgar Score. Journal of the American Medical Association, 1972, 219, 1322-1325.

Schillman, H. Maternal and Fetal Acid-Base Balance in Labor. Clinical Anesthesia, 1971, 10, 113-120.

Spradlin, F. The Effect of the Dorsal and Lateral Position of the Pregnant Woman on the Fetal Heart Rate. Akusherstvo Iginekologia (Moscow) 1972, 11, 311.

Tejani, N., Mann, L. and Bhakthavathsalan, A. Correlation of FHR patterns and Fetal pH with Neonatal Outcome. Obstetrics and Gynecology, 1976, 48, 460-463.

Tryon, P. Assessing the Progress of Labor Through Observation of Patient's Behavior. Nursing Clinics of North America, 1968, 3, 315-326.

Tryon, P. Use of Comfort Measures as Support During Labor. Nursing Research, 1966, 15, 109-116.

Ueland, K., and Hansen, J. Maternal Cardiovascular Dynamics II. Posture and Uterine Contractions. American Journal of Obstetrics and Gynecology, 1969, 103, 1-7.

Ueland, K., and Hansen, J. Maternal Cardiovascular Dynamics III. Labor and Delivery Under Local and Caudal Analgesia. American Journal of Obstetrics and Gynecology, 1969, 103, 8-18.

Van Slyke, D. A Survey of the History of the Acid-Base Field. In R. Winters (Ed.), The Body Fluids in Pediatrics: Medical Surgical, and Neonatal Disorders of Acid-Base Status, Hydration, and Oxygenation. Boston: Little, Brown, 1973.

Vorys, N., Ullery, J. and Hanusek, G. The Cardiac Output Changes in Various Positions in Pregnancy. American Journal of Obstetrics and Gynecology, 1961, 82, 1312-1321.

Whitely, Nancy. Uterine Contractile Physiology: Applications in Nursing Care and Patient Teaching. Journal of Obstetrics, Gynecology and Neonatal Nursing, 1975, 4, 54-58.

Wiedenbach, E. Clinical Nursing: A Helping Art. New York: Springer, 1967.

Williams, A. Normal Uterine Action in Labor. Journal of Obstetrics and Gynecology of the British Empire, 1952, 59, 635.

Wood, C., Keng, K., Hounslow, D., and Benning, H. A Control Trial Demonstrates that Speeding Birth Favourably Affects Cord Blood pH. Journal of Reproduction and Fertility, 1974, 36, 472-473.

APPENDICES

Appendix A

Informed Consent

INFORMED CONSENT

!, ________________________________, herewith agree to serve as a subject in the investigation entitled "THE EFFECT OF MATERNAL POSITION DURING LABOR ON FETAL OUTCOME" under the direction of Marie C. Berger, R.N., M.S. and Mary Carpenter, R.N., B.S.

The purpose of the investigation is to determine the effect of an upright and side maternal position during labor on the newborn.

In understand that I will be part of the control group of this investigation. I will not assume a pre-determined position during labor.

I understand that the progress of my labor and the baby's condition will be observed by a fetal monitor. The fetal monitor records the baby's heartbeat on a strip of graph paper. On the same strip of graph paper and at the same time, the fetal monitor records the timing and strength of my uterine contractions. The baby's heart rate is recorded from a tiny spiral electrode inserted vaginally and attached to the baby. Labor contractions are recorded by the use of a small, soft plastic tube called a catheter which is filled with sterile water and inserted vaginally or by a light-weight pressure sensor strapped across my abdomen. These devices will remain in place until a few minutes before the baby is born. This procedure of fetal monitoring is carried out in 75% of mothers who deliver at the University of Oregon Health Sciences Center and has not been altered for this study.

I understand that after the delivery of my baby and following clamping of the umbilical cord, a teaspoon of blood will be taken from the remaining cord. This blood sample will not be taken directly from the baby. The sample of blood will be analyzed for its acidic properties.

The complications of the above treatment could be scalp infection from attachment of the fetal electrode, maternal infection from placement of the uterine catheter and hemorrhage from attachment of the fetal electrode and other complications as yet to be identified. However, such complications would occur only very rarely.

I realize that I may not personally benefit from these procedures but, by serving as a subject in this study, I will contribute to new knowledge which may benefit others.

Ms. Carpenter has agreed to answer any further questions. I understand that my participation in this investigation will in no way alter my care during labor and delivery of my baby. I understand that I am free to refuse to participate or to withdraw from participation in this investigation at any time and that this will in no way influence my relationship with or treatment at the University of Oregon Health Sciences Center.

I have read the foregoing information.

Date: ______________________ ______________________
Subject's signature

Time: ______________________ ______________________
Witness

INFORMED CONSENT

I, ________________________________, herewith agree to serve as a subject in the investigation entitled "THE EFFECT OF MATERNAL POSITION DURING LABOR ON FETAL OUTCOME" under the direction of Marie C. Berger, R.N., M.S. and Mary Carpenter, R.N., B.S.

The purpose of the investigation is to determine the effect of an upright and side maternal position during labor on the newborn.

I understand that I will be in a sitting position on my right or left side, during my labor.

I understand that the progress of my labor and the baby's condition will be observed by a fetal monitor. The fetal monitor records the baby's heartbeat on a strip of graph paper. On the same strip of graph paper and at the same time, the fetal monitor records the timing and strength of my uterine contractions. The baby's heart rate is recorded from a tiny spiral electrode inserted vaginally and attached to the baby. Labor contractions are recorded by the use of a small, soft plastic tube called a catheter which is filled with sterile water and inserted vaginally or by a light-weight pressure sensor strapped across my abdomen. These devices will remain in place until a few minutes before the baby is born. This procedure of fetal monitoring is carried out in 75% of mothers who deliver at the University of Oregon Health Sciences Center and has not been altered for this study.

I understand that after the delivery of my baby and following clamping of the umbilical cord, a teaspoon of blood will be taken from the remaining cord. This blood sample will not be taken directly from the baby. The sample of blood will be analyzed for its acidic properties.

The complications of the above treatment could be scalp infection from attachment of the fetal electrode, maternal infection from placement of the uterine catheter and hemorrhage from attachment of the fetal electrode and other complications as yet to be identified. However, such complications would occur only very rarely.

I realize that I may not personally benefit from these procedures but, by serving as a subject in this study, I will contribute to new knowledge which may benefit others.

Ms. Carpenter has agreed to answer any further questions. I understand that my participation in this investigation will in no way alter my care during labor and delivery of my baby. I understand that I am free to refuse to participate or to withdraw from participation in this investigation at any time and that this will in no way influence my relationship with or treatment at the University of Oregon Health Sciences Center.

I have read the foregoing information.

Date: ______________________ ______________________
Subject's signature

Time: ______________________ ______________________
Witness

Appendix B

Raw Data

Raw Data

Control Group

Subject	Age	G	P	Apgar Score One-minute	Apgar Score Five-minute	Cord pH	Dominant FHR Pattern and Length of Labor I	Dominant FHR Pattern and Length of Labor II
1	22	1	0	6	8	7.17	Normal (2.6)	Variable deceleration with normal baseline (1.6)
2	29	2	1	7	10	7.23	Late deceleration (1.4)	Variable deceleration with normal baseline (0.26)
3	21	1	0	7	9	7.19	Normal (1.4)	Variable deceleration with abnormal baseline (0.73)
4	26	3	2	9	9	7.26	Normal (2.0)	Variable deceleration with normal baseline (0.33)
5	25	5	3	9	9	7.36	Early deceleration (2.53)	Uncomplicated baseline bradycardia (0.40)
6	23	1	0	8	9	7.21	Variable decleration with normal baseline (4.6)	Variable deceleration with abnormal baseline (0.50)
7	21	1	0	9	9	7.27	Uncomplicated base-line bradycardia (5.5)	Variable deceleration with abnormal baseline (0.96)

Raw Data

Control Group

Subject	Age	G	P	Apgar Score		Cord pH	Dominant FHR Pattern and Length of Labor	
				One minute	Five-minute		I	II
8	28	1	0	9	9	7.13	Variable deceleration with normal baseline (4.3)	Variable deceleration with normal baseline (1.26)
9	20	1	0	7	9	7.35	Variable decleration with normal baseline (1.06)	Variable decleration with normal baseline (1.00)
10	20	2	1	8	9	7.25	Normal (1.7)	Variable deceleration with abnormal baseline (0.3)
11	20	1	0	9	10	7.27	Early decelerations (2.75)	Variable deceleration (0.8)
12	20	1	0	9	9	7.25	Normal (3.8)	Uncomplicated baseline bradycardia (0.66)
13	23	2	1	8	9	7.44	Normal (1.25)	Early decelerations (0.36)
14	30	2	1	9	9	7.14	Variable deceleration with normal baseline (2.0)	Variable deceleration with abnormal baseline (0.26)

Raw Data

Control Group

Subject	Age	G	P	Apgar Score One-minute	Apgar Score Five-minute	Cord pH	Dominant FHR Pattern and Length of Labor I	Dominant FHR Pattern and Length of Labor II
15	27	4	3	9	9	7.29	Variable deceleration with normal baseline (2.0)	Variable deceleration with normal baseline (0.3)
16	23	2	1	5	10	7.19	Late deceleration (5.0)	Uncomplicated baseline bradycardia (0.33)
17	23	1	0	7	10	7.20	Normal (4.33)	Late deceleration (0.85)
18	22	1	0	8	9	7.18	Uncomplicated loss of beat-to-beat (7.6)	Variable deceleration with normal baseline (1.33)
19	20	2	1	8	9	7.19	Normal (2.16)	Early deceleration (2.0)
20	21	3	1	9	9	7.29	Normal (2.25)	Early deceleration (0.33)

Raw Data

Upright, Lateral Group

Subject	Age	G	P	Apgar Score		Cord pH	Dominant FHR Pattern and Length of Labor	
				One-minute	Five-minute		I	II
1	22	1	0	8	9	7.29	Variable deceleration with normal baseline (7.5)	Variable deceleration with abnormal baseline (0.5)
2	29	3	1	8	9	7.37	Normal (2.9)	Normal (0.26)
3	22	1	0	7	9	7.30	Uncomplicated loss of beat-to-beat (1.75)	Variable deceleration with normal baseline (0.5)
4	25	3	2	8	10	7.37	Normal (2.0)	Normal (0.20)
5	32	5	3	9	10	7.27	Normal (3.0)	Variable deceleration with normal baseline (0.73)
6	22	1	0	9	10	7.34	Normal (2.75)	Variable deceleration with normal baseline (0.26)
7	23	3	0	8	9	7.29	Variable deceleration with normal baseline (2.5)	Variable deceleration with normal baseline (0.5)

Faw Data

Upright, Lateral Group

Subject	Age	G	P	Apgar Scale One-minute	Apgar Scale Five-minute	Cord pH	Dominant FHR Pattern and Length of Labor I	Dominant FHR Pattern and Length of Labor II
8	31	3	0	8	9	7.26	Normal (5.5)	Normal (2.0)
9	20	2	0	9	10	7.40	Acceleration (5.0)	Normal (0.75)
10	21	1	0	8	9	7.28	Normal (3.0)	Variable deceleration with normal baseline (0.75)
11	20	1	0	9	9	7.29	Early deceleration (5.25)	Variable deceleration with normal baseline (0.5)
12	21	1	0	8	9	7.32	Accleration (3.0)	Normal (0.75)
13	26	2	1	7	8	7.21	Uncomplicated baseline bradycardia (1.5)	Variable deceleration with normal baseline (0.2)
14	26	2	1	8	9	7.35	Accleration (6.1)	Normal (0.5)
15	26	4	3	9	10	7.36	Early deceleration (1.75)	Normal (0.2)

Raw Data

Upright, Lateral Group

Subject	Age	G	P	Apgar Score One-minute	Apgar Score Five-minute	Cord pH	Dominant FHR Pattern and Length of Labor I	Dominant FHR Pattern and Length of Labor II
16	24	2	1	9	9	7.25	Normal (0.75)	Uncomplicated baseline bradycardia (0.13)
17	22	1	0	8	9	7.22	Variable deceleration with abnormal base-line (2.0)	Variable deceleration with abnormal baseline
18	20	1	0	8	9	7.28	Normal (4.33)	Variable deceleration with normal baseline (0.5)
19	21	3	1	7	9	7.32	Acceleration (3.16)	Variable deceleration with normal baseline (0.33)
20	22	3	1	9	10	7.26	Uncomplicated base-line bradycardia (3.0)	Uncomplicated baseline bradycardia (0.20)

AN ABSTRACT OF THE THESIS OF

MARY ELLEN CARPENTER

for the Master of Nursing

Date of receiving this degree: June 11, 1977

Title: THE EFFECT OF MATERNAL POSITION DURING LABOR ON FETAL OUTCOME

Approved: ____
Marie Berger, M.S., Associate Professor, Thesis Advisor

The majority of women in this country labor and deliver their infants on their backs. Past and present research has documented that the dorsal or recumbent position in childbirth is not physiologically sound during pregnancy or labor. The effects of position in childbirth on the cardiovascular, renal and pulmonary systems, uterine contractility and length of labor have been examined. To date few studies have documented the effect of position in childbirth on the fetus.

Patient positioning is an acknowledged nursing intervention. The practice of positioning labor and delivery patients has been performed as a comfort measure but otherwise is implemented with little understanding of the underlying scientific principles.

This study was undertaken to determine the effect of maternal position during labor on fetal outcome. The study was an experimental

post-test only control design. The independent variable was maternal 30° upright, lateral position. Fetal outcome measured by Apgar scores, acid-base status of the fetus, and fetal heart rate patterns, was the dependent variable. Subjects were from the patient population of a university hospital. Selection criteria for inclusion was:

1. Age - 18-35 years
2. Normal pelvic structure by clinical exam
3. Single vertex presentation
4. No indication of cephalopelvic disproportion, biophysical pathology, or psychiatric disorder
5. 38-42 weeks gestation
6. Spontaneous onset of labor
7. Anticipated local anesthesia for delivery

Forty intrapartum women were divided into two groups. One group assumed a 30° upright, lateral (either side) position during the first stage of labor and a 30° upright position for delivery. The other group did not receive this nursing intervention.

Both groups were monitored during labor with commercially available fetal monitors. Apgar scores were recorded at one and five minute intervals and umbilical cord blood samples were measured for pH.

Data was analyzed by means, standard deviations, the student's t-test for unpaired samples, and the Chi Square. A significant difference was found between the mean blood pH values of the control and experimental groups. The mean blood pH of the control group was 7.24 and the experimental, 7.30. No statistical differences were found between the two groups in relation to Apgar scores and incidence of abnormal fetal heart rate patterns. However, the incidence of abnormal fetal heart rate patterns in the experimental group was less than that previously reported.

Conclusions drawn from this study were that maternal position during labor has a definite influence over fetal outcome. Unexpected nursing implications surfaced. These were increased maternal comfort in the upright lateral position and the opportunity to further maternal-infant bonding. Recommendations for further studies were made.

AN ABSTRACT OF THE THESIS OF

MARY ELLEN CARPENTER

for the Master of Nursing

Date of receiving this degree: June 11, 1977

Title: THE EFFECT OF MATERNAL POSITION
[redacted]UTCOME

Approved: [redacted]
[redacted] Professor, Thesis Advisor

The majority of women in this country labor and deliver their infants on their backs. Past and present research has documented that the dorsal or recumbent position in childbirth is not physiologically sound during pregnancy or labor. The effects of position in childbirth on the cardiovascular, renal and pulmonary systems, uterine contractility and length of labor have been examined. To date few studies have documented the effect of position in childbirth on the fetus.

Patient positioning is an acknowledged nursing intervention. The practice of positioning labor and delivery patients has been performed as a comfort measure but otherwise is implemented with little understanding of the underlying scientific principles.

This study was undertaken to determine the effect of maternal position during labor on fetal outcome. The study was an experimental

post-test only control design. The independent variable was maternal 30° upright, lateral position. Fetal outcome measured by Apgar scores, acid-base status of the fetus, and fetal heart rate patterns, was the dependent variable. Subjects were from the patient population of a university hospital. Selection criteria for inclusion was:

1. Age - 18-35 years
2. Normal pelvic structure by clinical exam
3. Single vertex presentation
4. No indication of cephalopelvic disproportion, biophysical pathology, or psychiatric disorder
5. 38-42 weeks gestation
6. Spontaneous onset of labor
7. Anticipated local anesthesia for delivery

Forty intrapartum women were divided into two groups. One group assumed a 30° upright, lateral (either side) position during the first stage of labor and a 30° upright position for delivery. The other group did not receive this nursing intervention.

Both groups were monitored during labor with commercially available fetal monitors. Apgar scores were recorded at one and five minute intervals and umbilical cord blood samples were measured for pH.

Data was analyzed by means, standard deviations, the student's t-test for unpaired samples, and the Chi Square. A significant difference was found between the mean blood pH values of the control and experimental groups. The mean blood pH of the control group was 7.24 and the experimental, 7.30. No statistical differences were found between the two groups in relation to Apgar scores and incidence of abnormal fetal heart rate patterns. However, the incidence of abnormal fetal heart rate patterns in the experimental group was less than that previously reported.

Conclusions drawn from this study were that maternal position during labor has a definite influence over fetal outcome. Unexpected nursing implications surfaced. These were increased maternal comfort in the upright lateral position and the opportunity to further maternal-infant bonding. Recommendations for further studies were made.