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İntrapartum Fetal Kafa Derisi Laktat Seviyesinin Fetus ve Yenidoğan Sonuçlarını Öngörmedeki Yeri

Assessment of Fetal Scalp Lactat Levels for The Determination of Fetal and Neonatal Well-being

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ÖZ

GİRİŞ ve AMAÇ: *Perinatal hipoksik stres, yenidoğanda mortalite, morbidite ve nörolojik sekellerin gelişiminde en önemli etyolojik faktörüdür. Yenidoğan hipoksisi her yıl 130 milyon doğumun 4 milyonunda görülmekte ve bir milyon yenidoğan asfiksi ya da ciddi sekeller sonucunda ölmektedir. İntrapartum fetal izlem yönetim yöntemleri fetal pulse oksimetre ve eksternal kalp atım oranlarını içermektedir. Bu testlerin bazı avantaj ve dezavantajları vardır ve bu metodlardan hiçbirisi yüksek duyarlılık ve özgüllük oranına sahip değildir. Çalışmamızın amacı intrapartum fetal skalp laktat seviyesinin ölçülerek fetal ve yenidoğan mortalite ve morbidite oranlarını öngörmedeki yerinin analiz edilmesidir.*

YÖNTEM ve GEREÇLER: *Çalışmaya 95 gebe dahil edilmiştir. Hastalar misoprostol ile indüklenmiş olup eksternal fetal kalp atım hızı, fetal pulse oksimetre ve fetal skalp kan laktat seviyeleri takip edilmiştir. Umblikal arteriel kan oksijen testi ölçülerek kaydedilmiştir.*

TARTIŞMA ve SONUÇ: *Fetal skalp laktat izlemi, sadece anlık laktat seviyesini yansıtan invaziv bir yöntem olduğu için, tekrarlama ihtiyacı ve hipoksik fetus için zaman kaybı anlamına gelen zaman ve emek ihtiyacı, klinikte yer almasının zor nedenlerinden biridir Uygulama. Fetal skalp laktat izleminin klinikte yer almasının güç olmasınınsebepleri, anlık laktat seviyesini yansıtan invaziv bir yöntem olması, tekrarlama ihtiyacı ve hipoksik fetus için vakit kaybı anlamına gelen zaman ve emek ihtiyaçlarıdır. Bu yöntemin rutin pratikte kullanılması daha pratik ve noninvaziv teknolojik yöntemler geliştirilene kadar pek olası değildir.*

Anahtar Kelimeler: *Fetal, skalp, laktat, hipoksi,*

ABSTRACT

INTRODUCTION: *Perinatal hypoxic stress is the most important etiological factor of newborn mortality, morbidity and norological sequellae. Every year newborn asphyxia occurs in approximately four million of 130 million births and one million of newborn dies as a consequence of asphyxia, or is exposed some kind of a severe sequellae. Assessment of intrapartum fetal monitoring includes fetal pulse oksimeter and external fetal heart rate monitoring. These tests has some advantages and disadvantages and none of these methods have high sensitivity and specificity rates.The aim of our study was to investigate the reduction of fetal and neonatal mortality and morbidity rates by measuring fetal scalp lactate levels.*

METHODS: *A total of 95 pregnant women were enrolled in the study. All the patients were misoprostol-induced and monitored with external fetal heart rate, fetal pulse oksimeter and fetal scalp lactat level. Umbilical arterial blood oxygen testing were measured and recorded.*

RESULTS: *Fetal oxygen saturation was under 30% in 24 (25%), and fetal scalp lactat level was above 4.8 mmol/L in 15 (16%) of the patients. These results indicated a statistically significant correlation between newborn acidosis and necessity of intensive care unit ($p<0.05$).*

DISCUSSION and CONCLUSION: *As for fetal scalp lactate monitoring is an invasive method, reflecting only the momentary lactate level, the need for repetition and the need for time and effort which means loss of time for the hypoxic fetus are the main reasons why it's hard to take place in clinical practice. It's not very probable for this method to be used in routine until more practical andnoninvasive methods are developed within technological improvement.*

Keywords: *Fetal, scalp, lactate, hypoxi*

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INTRODUCTION

Perinatal hypoxic stress is the most important etiological factor of newborn mortality, morbidity and norological sequellae. Every year newborn asphyxia occurs in approximately four million of 130 million births and one million of newborn dies as a consequence of asphyxia, or is exposed some kind of a severe sequellae (1).

Fetus can feel pain in the last period of pregnancy and can respond to pain by fetal heart rate changes independant from pregnancy. Delivery is the most important stress for the fetal life causing different grades of pain and hypoxia.

Science of obstetrics firstly aims to protect mother's life, and protect fetus'es life secondly. Intrapartum fetal monitoring gives the oppurtunity to diagnose asphyxia in the early stages of labor and in this way may give chance to prevent neonatal mortality ad morbidty. Improvements in intrapartum monitoring and newborn intensive care have given us the chance to decrease perinatal morbidity and mortality dramatically.

Assessment of intrapartum fetal monitoring includes fetal pulse oksimeter and external fetal heart rate monitoring. These tests has some advantages and disadvantages and none of these methods have high sensitivity and specificity rates (2, 3).

Unfortunately, there is not an ideal test for the determination of a fetus under risk or none of the methods can totally prevent fetal death. However, recent studies have shown that while a reassuring fetal heart rate pattern indicates a healthy fetus, a non-reassuring fetal heart rate pattern does not always indicate an ill fetus (4).

In addition to these non-invasive tests, fetal scalp blood sampling is an invasive test that can be used in high risk pregnancies during labour only with an indication. It is not recommended for routine practice.

The aim of our study was to investigate the reduction of fetal and neonatal mortality and morbidity rates by measuring fetal lactate levels.

MATERIAL and METHOD

The study has been conducted in between May 2010 and May 2011 at the Kocaeli University Departments of Obstetrics and Gynecology. Local ethics Committee has approved the study.

The study included 95 women with a singleton fetus with vertex presentation in between 32-42 weeks of gestation. Women with the diagnosis of placenta previa, placental abruption, vaginal bleeding of an unkown cause, multiple pregnancy, presentation anomalies, and genital infection were excluded from the study.

During labour, intrapartum fetal monitoring signs, oxygen saturation levels by measuring fetal pulse oksimeter, fetal lactate values, and the mode of delivery were detected. Neonatal Apgar scores, Neonatal Intensıve Care Unit (NICU) admission, duration of hospital stay, resuscitation, intubatıon, surfactant application and mechanical ventilation requirements, intracranial hemorrhage, hypoglycemia, respiratory distress syndrome and meconium aspiration syndrome, fetal infection, fetal sepsis, dehydration and neonatal death were recorded.

Placental location, presentation, amniotic fluid index measurement (AFI) were screened by using `Medison Sonoace-X8 Ultrasound System` Ultrasonography with 3.5 MHz abdominal probe and average fetal biometry and estimated fetal birth weight were determined according to the Hadlock Programme.

Prior to the administration of misoprostol, one of the two obstetrics & gynecology specialists performed a vaginal examination to assess the cervix and a NST was routinely performed before applying the medication. Subsequent assessment of the Bishop score was done by the same initial examiners until delivery. After confirmation of a reactive NST and a Bishop score of <5, 50 mcgr misoprostol tablet was placed sublingually for the induction of labour and women were instructed not to chew or swallow the medication or drink anything within an hour of medication. Each 50 mcgr dose was prepared by quartering a 200 mcgr misoprostol tablet by one of the two senior residents in obstetrics & gynecology. The misoprostol was repeated every 4 hour up to six doses. Labour induction was considered successful if women were delivered within 24 hour of initiation of misoprostol. Oxytocin induction of

labour was used in women in whom misoprostol had failed to induce labour by the 24th hour. Early artificial rupture of the membranes was performed when cervical dilatation was >3 cm in cases without premature rupture of the membranes. When Bishop score was >6, oxytocin augmentation was started at a rate of 1 mU/min, which was increased at 15minute intervals until contractions of 200–250 Montevideo units were achieved. Oxytocin was not administered earlier than 4 hour after the last dose of misoprostol.

After administration of misoprostol, women underwent electronic fetal heart rate(FHR) monitoring with cardiotogram (CTG), a Nellcor FS14 (Puritan Bennett, CA) fetal oxygen sensor was placed through the cervix between the uterine wall and the fetal cheek and temple intermittantly 15 minute every 2 hour. In all the women, placement was easy when cervical dilatation was >3 cm. One probe was used for each patient. For intermittant administration the probe was cleaned with sterile saline and kept between sterile gauses in a sterile pack. The sensor was successfully placed in all women. Fetal scalp lactate level was measured in the acceleration stage of active phase of labour due to high degree of stress of the fetus at this level.

Non-reassuring FHR pattern included: (1) persistant or recurrent episodes of severe variable decelerations (variable decelerations occurring in 50% of all contractions detected in a period of 30 minute); (2) repetitive late decelerations (late decelerations occurring in 50% of all contractions detected in a period of 30 min); (3) prolonged fetal bradycardia; and (4) a combination of decreased beat-to-beat variability and a decelerative pattern. Tachysystole was defined as six or more uterine contractions in 10 min for two consecutive 10 minute periods. Uterine hyperstimulation was defined as the presence of tachysystole associated with non-reassuring FHR patterns

Each patient with a reassuring fetal heart rate pattern and above %30 pulse-oxymeter values while at least 5 cm of cervical dilatation with active uterine contractions was seperated from fetal pulse oxymeter and external fetal monitoring; then taken to the gynecology table. Fetal scalp was visualized by a sterile speculum. Blood samples were taken with the help of Micro Blood exraction Kit from the fetal scalp (Oppelt “easy check” MEB-sets, miatur blade for 26212, drum light source, coarse thread, clinitubes capillary tubes) and lactate levels were mesured by Lactate Pro LT-1710 Blood Lactate Test Meter. Fetuses that had non-reassuring external fetal monitoring findings with fetal oxygen saturation values below 30% at least two minutes, and with lactate levels above 4.8 mmol/L were delivered with the most appropriate way without delay. Fetal scalp lactate measeruments were repeated after 20-30 min in cases with a suspiscion of fetal acidosis with fetal scalp lactate levels in between 4.2-4.8 mmol/L. Patients with fetal scalp lactate levels below 4.2 mmol/L were continued to follow during labour.

Fetal scalp lactate levels of the infants were assessed as soon as the head is delivered from the cesarrean incision and in this way all the newborns lactate levels were obtained. After C/S or vaginal delivery; the cord blood from umblical artery was taken into a 2 cc blood gas enjector washed with heparin to measure umblical artery blood gas levels (pH, lactate, anion gap) (Biobak 855 Ciba – Corning). Those newborns with a pH value below 7.2 were considered as fetal acidosis.

Statistical analysis of the data was performed with the aid of statistical software (Statistical Package for the Social Sciences, SPSS, Chicago, IL). Results were reported as mean+standard deviation or numbers and percentages. All analyses performed were two tailed, and $p<0.05$ was accepted as indicating statistical significance. The Chi-square or Fisher’s test was used for categorical variables whenever suitable. Independent sample t-test was used to analyse continuous variables.

RESULTS

Sociodemographic parameters of the 95 patients that were allocated in the study were compared according to age, gravida, parity, miscarriage, smoking, hyperemesis gravidarum or history of miscarriage and revealed no differences in both the vaginal delivery group and the cesarrean section group. No statistically significant difference was detected in the vaginal delivery group and the cesarrean section group when compared according

to gestational age, preterm rupture of membranes, gestational diabetes, or type 2 diabetes.

Fetal pulse oximeter, external fetal monitoring patterns, fetal scalp lactat levels and umbilical arterial blood ph values were statistically significantly different in patients with vaginal delivery and cesarrean sectios. External fetal heart rate monitoring, fetal oygen saturations, fetal scalp lactat values and umblical arterial blood pH values are presented in Table 1.

Table 1. External fetal heart rate(FHR) monitoring, fetal oxygen saturation, fetal scalp lactat levels and umblical arterial blood ph levels.

	Vaginal Birth (n:67)	**Cesarrean Sections (n:28)**	**P value**
Non-reassuring FHR pattern	5 (7.5)	8 (28.6)	<0.05
Early Deceleration	14 (20.9)	6 (21.4)	
Variable Deceleration	1 (1.5)	0 (0)	
Late Deceleration	1 (1.5)	12 (42.8)	
Pulse Oximeter <%30	9 (13.4)	15 (53.6)	<0.05
Fetal scalp lactat level >4.8 mmol/l	6 (8.9)	9 (32.1)	<0.05
Umblical arterial blood pH<7.2	6 (8.9)	5 (7.8)	<0.05

Statistically significant differences were determined in patients with vaginal delivery and cesarrean sectios with respect to intensive care unit admission, surfactant applications and intubation rates (Table 2).

Table 2. Newborns results.

	Vaginal Birth (n:67)	Cesarrean Sections (n:28)	P value
NICU Admission	6 (8.9)	18 (64.2)	<0.05
Surfactant Application	4 (6)	12 (42.8)	<0.05
Intubation	4 (6)	12 (42.8)	<0.05

Surfactant application, intubation need, umblical arterial blood gas ph values and first minute Apgar Scores were statistically significantly different among newborns and represented in Table 3.

Statistically significant difference was determined among newborns according to fetal pulse oximeter values (Table 4).

Tablo 3. Newborns results acording to fetal scalp lactate levels.

	Fetal scalp lactate level<4.8 mmol/l (n: 84)	Fetal scalp lactate level ≥4.8 mmol/l (n:11)	P value
NICU Admission	17 (20.2)	7 (63.6)	<0.05
Surfactant Application	12 (14.3)	4 (36.4)	<0.05
Intubation	12 (14.3)	4 (36.4)	<0.05
Umblical arterial < pH 7.2	6 (7.1)	5 (45.4)	<0.05
1.minute Apgar score ≤6	5 (6)	3 (27.3)	< 0.05

Table 4. Newborns results according to pulse oximeter results.

	Pulse Oximeter < % 30 (n:24)	Pulse Oximeter ≥ % 30 (n:71)	P value
NICU Admission	16 (66.6)	8 (11.3)	<0.05
Surfactant Application	13 (54.2)	3 (4.2)	<0.05
Intubation	13 (54.2)	3 (4.2)	<0.05
Umblical arterial < pH 7.2	8 (33.3)	3 (4.2)	<0.05
1.minute Apgar score ≤6	6 (25)	2 (2.8)	<0.05

DISCUSSION

Assessment of intrapartum fetal well-being exactly is usually difficult and is one of the biggest problems in obstetrics (6). External fetal heart rate monitoring is the most frequent method worldwide to evaluate intrapartum fetal well-being. External fetal heart rate monitoring is a non-invasive method with no contraindications and can even be performed on outpatients (7, 8).

While it has high sensitivity to obtain hypoxia, external fetal monitoring has low specifity (9). Not all reassuring heart rate patterns detected in external heart rate monitoring are related to the loss of fetal well- being and the rate of fetal acidosis detected in the c/s births lead by non-reassuring fetal monitoring is 50% at most (10, 11).

The difficulties in diagnosing the fetal distress and the clinical conflict have lead the clinicians to search for a new way to determine the fetal well-being. Fetal pulse oximetry and measuring of fetal scalp lactate levels are the new methods that aim to determine the fetal acidosis in the last years (12, 13).

Saling and colleagues have published a study in which fetal pH is measured by fetal scalp sampling.

They evaluated below pH 7.20 as acidosis, 7.20-7.25 as suspicious, over 7.25 as normal (14). In our study we compared 47 (49.5 %) cases that have non-reassuring external fetal monitoring findings to those of 48 (50.5 %) cases that have reassuring external fetal monitoring findings. Among the cases that have non-reassuring external fetal monitoring findings, we detected that 9(19.1 %) infants had umbilical artery pH values below 7.2. 2 (%4.2) infants among the reassuring external fetal monitoring cases had umbilical artery pH value below 7.2. The disparity between the reassuring and non-reassuring external fetal heart rate monitoring is similar to those in the study published by Gilstrop and colleagues (15).

The FDA has suggested the use of fetal pulse oximetry with the external fetal heart rate monitoring and stated that no technology can be a 100 % indicator of the fetal acid-base status (16). The findings obtained about this subject are detailed below. Van den Berg and colleagues have claimed that the use of fetal pulse oximetry can reduce the rate of unnecessary interventions in cases with abnormal fetal heart rate patterns but may also cause the acidotic cases go unnoticed (17). Lutkus and colleagues have shown in their study that the combined use of external fetal heart rate monitoring with fetal pulse oximetry has increased the success in obtaining fetal acidosis and the need of neonatal intensive care unit (18).

Need for neonatal ICU was detected in 16 cases out of 24 in which the pulse oximetry was below 30% for longer than 2 minutes, in 8 cases pH was below 7.2. Similar to the results of Luttkus and colleauges' study, we found out that predicting fetal acidosis and the need for neonatal ICU is more successful when the use of fetal monitoring and pulse oximetry is combined.

Heiniz AM and colleagues have published a study in which they obtained acidosis in the cases with fetal scalp lactate level over 6.6 mmol/L (19). In our study we measured the umbilical cord pH value below 7.2 of 11 (45.4 %) cases which had fetal scalp lactate level above 4.8 mmol/L and we found out that the increase in the fetal scalp level is correlated with fetal acidosis.

Lactate is an anaerobic metabolism product and can be detected in elevated levels in stress. It's an indicator of tissue hypoxia. Fetal scalp lactate measurement is a reliable method when there is doubt for intrapartum fetal distress. The measurement reflects the amount at that moment so the test must be repeated when there is doubt. The measured values below 4.2 mmol/L is normal, labor can proceed. Between 4.2 – 4.8 mmol/L is suspicious for acidosis and must be repeated in 20 minutes. Above 4.8 mmol/L is an indicator for acidosis and labor must happen (20).

The gold standard test for intrapartum fetal evaluation is external fetal monitoring. When non-reassuring fetal heart rate pattern is detected, other intrapartum fetal well-being tests must be performed. Checking fetal oximetry values before fetal scalp lactate level measurement, protect the fetus from unnecessary intervention and buys more time. Therefore intrapartum fetal well-being tests must be performed on the fetus in an order and give valuable information when combined in use.

Fetal head has to be located in the pelvis and the cervix has to be dilated in order to do fetal scalp sampling to obtain fetal distress. This method only gives the fetal oxygenation results of the moment when the test is performed so it may need to be repeated and must be performed in a gynecological examination chair which makes this method invasive and harder to practice than other methods.

The main limitation of our study is the small sample size(n=95) as this prevented us from values corralates with critical lactate values commonly used. Larger sample sizes will be better to define the sensitivity and specifity of this testing method for determination of fetus and neonatal well-being.

When other methods strongly suggest fetal acidosis, losing time for fetal scalp sampling can cause irreversible fetal complications. As for fetal scalp lactate monitoring is an invasive method, reflecting only the momentary lactate level, the need for repetition and the need for time and effort which means loss of time for the hypoxic fetus are the main reasons why it's hard to take place in clinical practice. It's not very probable for this method to be used in routine until more practical

and non-invasive methods are developed within technological improvement.

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