Research Article / Araştırma Makalesi

Retrospective Study of the Perinatal Asphyctic Cases That Developed Mortality

Mortalite Gelişen Perinatal Asfiksi Olguların Retrospektif İncelenmesi

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Abstract

Background: In this study, we aimed to investigate the pH, base deficit (BD), retinal changes, and amplitude-integrated electroencephalography (aEEG) findings of cases diagnosed with perinatal asphyxia (PA) and developing mortality
Materials and Methods: Seven patients with mortality due to perinatal asphyxia were included in this study. Blood gas analysis of cases, 72-hour aEEG findings were recorded. All babies were examined by the same ophthalmologist. Data analyses were performed using SPSS Statistics software
Results: Seven cases with perinatal asphyxia who developed mortality during follow-up were included in this study. The pH value of the cases was between 6.30-6.98 (6.84) and the BD was between 18-40 (23) mmol / L. Massive retinal hemorrhage was detected in 2 patients. In one patient, spot bleeding foci were more prominent in the right eye retina. When the aEEG findings of the postnatal 24th hour of the cases were evaluated, it was found that six patients had low voltage (LV) and one patient had burst suppression (BS) pattern. Our two cases died between the 24th and 48th hours and both cases were in the LV pattern. In the follow-up of four cases, it was observed that mortality developed after 72 hours. One of these four cases was the LV pattern and two were BS patterns. The patterns of the last case at 24-48 and 72 hours were BS-LV and DNV, respectively.
Conclusions: In our study, it was found that cases with developed mortality had severe abnormal aEEG findings. It was determined that the LV and BS pattern, which continued for 24-48 hours, were associated with the development of mortality and these results were consistent with the literature.

Key Words: Perinatal asphyxia, Mortality, Base deficit, aEEG, Retinal hemorrhage

Öz.

Amaç: Bu çalışmada perinatal asfiksi (PA) tanısı alan ve mortalite gelişen olguların pH, baz eksikliği (BD), retina değişiklikleri ve amplitüd-entegre elektroensefalografi (aEEG) bulgularını araştırmayı amaçladık.
Materyal ve Metod: Çalışmaya perinatal asfiksi nedeniyle mortalite gelişen yedi hasta dahil edildi. Olguların kan gazı analizi, 72 saatlik aEEG bulguları kaydedildi. Tüm bebekler aynı göz doktoru tarafından muayene edildi. Veri analizleri SPSS Statistics yazılımı kullanılarak yapıldı
Bulgular: Takip sırasında mortalite gelişen yedi perinatal asfiksi olgusu çalışmaya dahil edildi. Olguların pH değeri 6.30-6.98 (6.84) ve BD 18-40 (23) mmol / L arasındaydı. İki hastada masif retinal kanama saptandı. Bir hastada, spot kanama odakları sağ göz retinasında daha belirgindi. Olguların postnatal 24. saatteki aEEG bulguları değerlendirildiğinde, altı hastada düşük voltaj (LV), bir hastada patlama bastırma (BS) paterni saptandı. İki olgumuz 24. ve 48. saatler arasında öldü ve her iki olgu da LV modelindeydi. Dört olgunun takibinde mortalitenin 72 saat sonra geliştiği gözlendi. Bu dört vakadan biri LV paterni ve ikisi BS paterniydi. Son vakanın 24-48 ve 72. saatteki paternleri sırasıyla BS-LV ve DNV idi.
Sonuç: Çalışmamızda mortalite gelişen olgularda ciddi anormal aEEG bulguları olduğu bulundu. 24-48 saat devam eden LV ve BS paterninin mortalite gelişimi ile ilişkili olduğu ve bu sonuçların literatürle uyumlu olduğu belirlendi.
Anahtar kelimeler: Perinatal asfiksi, Mortalite, Baz defisiti, aEEG, Retinal kanama

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Introduction

Perinatal asphyxia (PA) is the most important cause of neurological morbidity in the term and preterm infants, and it is a serious condition that can increase the mortality rate by up to 35%. PA occurs due to arterial hypoxemia, hypercarbia, and metabolic acidosis, which occur as a result of impaired pulmonary ventilation due to insufficient placental gas exchange or postpartum events. In the fetal cord blood gas, pH value <7.00 indicates significant fetal acidemia. The fact that the base deficit is between 12-16 mmol / L suggests that the baby is born hypoxic, and >16 mmol / L suggests that the baby is in severe hypoxia. While mild asphyxia is associated with a good prognosis, severe asphyxia has been associated with high morbidity and mortality. Approximately 1/3 of infants with moderate and severe neonatal encephalopathy die in the neonatal period. Therefore, neuroimaging and neurophysiological examinations are of great importance in predicting prognosis in asphytic babies (1-3). In the amplitude-integrated electroencephalographic (aEEG) studies, good neurological results of patients with mild abnormal and normal traces have been reported in the long term. However, long-term results of patients with severe abnormal traces have been reported negatively (4). In asphytic cases, newborns with CNV and DNV findings lasting more than 24 hours in aEEG were likely to survive without sequelae, whereas babies with BS, CLV, and FT findings had a high risk of mortality or morbidity (1,5-7). The prognosis worsens and the morbidity-mortality rate increases as the severity of asphyxia in infants increases (8).

In this study, we aimed to investigate pH, Base Deficit (BD), retinal examination, and aEEG findings of patients diagnosed with PA and who developed mortality.

Materials and Methods

Seven patients who were diagnosed with PA in the tertiary neonatal intensive care unit between June 2017 and June 2019, treated with therapeutic hypothermia and developed mortality were included in the study. This study was approved by the Harran University Clinical Research Ethics Committee (Approval date and number: 11.05.2020, Session 09, Decision number:05) by the principles of the World Medical Association Helsinki Declaration, which was last revised in 2013.

Collection and Analysis of Blood Samples:

2 cc fetal blood samples were collected from the umbilical artery of all cases to the injector washed with heparin in an anaerobic environment.

After sampling, the needle of the injector was bent, and the injector tip was closed with the plastic cap, and fetal blood was prevented from coming into contact with oxygen. Blood gas parameters were determined within the first 30 minutes under cold chain conditions.

Retinal examination:

To determine the severity of optic atrophy and retinal hemorrhages which are likely to develop during perinatal asphyxia retinal examination in dilated pupil was performed for each patient. All babies were examined by the same ophthalmologist. Before the examination, 0.5% tropicamide and 2.5% phenylephrine solutions were dropped 2 times with an interval of 10 minutes, and pupil dilation was achieved. After using 0.5% proparacaine hydrochloride drops for topical anesthesia, the ophthalmological examination was performed by the ophthalmologist using a binocular indirect ophthalmoscope and 28 dioptric lenses with the help of pediatric valve speculum and depressor.

aEEG recording and classifications

All aEEGs were recorded within the first 80 hours of life by the doctor in charge of the infant using the Olympic CFM Brainz Monitor model aEEG device. aEEG recordings were made using 12 mm x 29 gauge needle electrodes (C3, C4, P3, P4, and COM). C3 (purple) and P3 (black) electrodes were placed in the left parietal region of the scalp, C4 (purple), and P4 (black) electrodes were placed in the right parietal region. The white reference electrode (COM) was also placed in the midline in the frontal region. aEEG recordings were made according to the Burdjalov scoring system. In the Burjdalov scoring system, the scoring model was made by evaluating continuity, the expression of sleep-wake cycling (SWC), the amplitude of the lower border (LBA), and the bandwidth (BW) (9). Table 1.

Table 1. Defining aEEG according to the pattern classification

Amplitude-integrated electroencephalographic pattern	Description
CNV	Continuous activity is the lowest amplitude of approximately 7-10 µV and upper amplitude 10-25 µV
DNV	Lowest amplitude is always under 5 µV and the upper is over 10 µV, discontinuous trace
BS	Discontinuous background pattern periods of very low (0-1(2) µV) voltage (inactivity) intermixed with bursts of higher amplitude(>25 µV level.)
CLV	The level pattern of the continuous very low voltage (around or under 5 µV).
FT	Under 5 µV, inactive line (isoelectric line).

CNV: Continuous normal voltage, DNV: Discontinuous normal voltage, BS: Burst suppression, CLV: Continuous very low voltage, FT: Flat line, with no activity

Statistical analysis

Data analyses were performed using SPSS Statistics software (version 24.0, SPSS Inc., Chicago, IL, USA). Descriptive statistics are summarized as the number, percentage, mean and standard deviation.

Results

The data of 89 patients who were followed up and treated with the diagnosis of perinatal asphyxia in the neonatal intensive care unit were evaluated. Seven cases with perinatal asphyxia who developed mortality during follow-up

were included in this study. The gestational age of the infants was between 36 – 42 (38) weeks, the birth weight was between 2300 – 3600 (2900) gr. 4 of the cases were female and 3 were male. The pH value of the cases was between 6.30-6.98 (6.84) and the base deficit was between 18-40 (23) mmol / L. (Table 2).

Table 2. Gestational week, birth weight, pH ve BD values of the cases.

	Gestational week	Birth weight (gr)	BD (mmol/L)	pH
Median	38,0000	2900,0000	21,0000	6,8400
Minimum	36,00	2300,00	-18,00	6,30
Maximum	42,00	3600,00	40,00	6,98
N	7	7	7	7

On postnatal 4-5th days, 4 patients underwent retinal examination. Massive retinal hemorrhage was detected in 2 patients. In one patient, spot bleeding foci were more prominent in the right eye retina. In the eye examination, one patient who did not develop any bleeding in any area also had prominent paleness on the optic disc.

When the aEEG findings of the postnatal 24th hour of the cases were evaluated, it was found that six patients had low voltage (LV) and one patient had burst suppression (BS) pattern. Our two cases died between the 24th and 48th hours and both cases were in the LV pattern. Base deficits at the time of admission was 40 mmol / L in one and 21 mmol / L in the other. One patient died between 48 and 72 hours postnatally. In our patient, the base deficit at the time of presentation was 33 mmol / L and it was detected in the LV pattern since the diagnosis. In the follow-up of four cases, it was observed that mortality developed after 72 hours. One of these four cases was the LV pattern and two were BS patterns. The patterns of the last case at 24-48 and 72 hours were BS-LV and DNV, respectively. (Table 3).

Table 3. The aEEG findings and mortality numbers of the cases at 0-72th hours of life.

	aEEG at 24th hour	aEEG at 24-48th hour	aEEG at 48-72th hour
BS	1	3	2
LV	6	2	1
DNV	0	0	1
CNV	0	0	0
Mortality	0	2	1
Total	7	7	7

BS: Burst suppression, LV: Low Voltage, DNV: Discontinuous normal voltage, CNV: Continuous normal voltage

Discussion

The fact that aEEG has a high early predictive value along with the simplicity of recording and analysis has led to the widespread use of this method in patients with perinatal asphyxia. (10). In randomized controlled trials, aEEG has been used as an inclusion criterion to start therapeutic hypothermia and as a tool for monitoring brain function throughout treatment. (10,11). A persistent abnormal aEEG of 24 hours or more was found to be associated with a negative neurodevelopmental outcome, and the patients were reported to have a poor neurological outcome after 1 year. According to the pattern classification of aEEG in perinatal asphytic patients, infants with CNV and DNV patterns are likely to survive without sequelae, while patients with BS, CLV, or FT patterns have a high risk of mortality or morbidity (12-14). Hellstrom-Westas L et al. (9) showed that BS, LV, or FT aEEG patterns are associated with mortality or morbidity and result in poor neurological prognosis. In our study, it was found that all the patients who were treated with therapeutic hypothermia with the diagnosis of perinatal asphyxia were in the LV and BS pattern for the first 24 hours.

In the blood gas determined from the fetal cord, the base deficit between 12-16 mmol / L suggests hypoxia, and> 16 mmol / L suggests that the baby is in severe hypoxia. While mild asphyxia results in good prognosis in infants, severe asphyxia has resulted in high morbidity and mortality (1-3). Kliegman Robert M et al. (15) showed that high base deficit is associated with mortality. In our study, it was shown that there was a high base deficit in patients who developed mortality.

Although the mechanism of neonatal retinal bleeding is unclear, increased blood viscosity, prostaglandins in the fetal circulation, abnormal pressure distribution during delivery, and sudden intracranial pressure change may be responsible. There is no trauma in most of the cases (16-18). Callaway NF et al. (19) found that retinal hemorrhages occur in approximately one-third of infants. It was found that retinal hemorrhages increase more frequently in prolonged deliveries, first and instrumental deliveries, and less in cesarean deliveries. Retinal hemorrhages are frequently seen in long-term deliveries, primipara and instrumental vaginal delivery, and less frequently in cesarean deliveries. In the retinal examination performed on the 4-5th days in our study, massive retinal hemorrhage in 2 patients and spot bleeding in the retina were detected in 1 patient. All cases who developed retinal hemorrhage had a difficult delivery.

In our study, all cases with mortality were found to have severe abnormal aEEG patterns and high BD. In cases with perinatal asphyxia, it was determined that the LV or BS pattern, which lasted 24-48 hours in aEEG, was associated with the development of mortality and these results were consistent with the literature.

Ethical Approval: This study was approved by the Harran University Clinical Research Ethics Committee (Approval date and number: 11.05.2020, Session 09, Decision number:05) by the principles of the World Medical Association

Helsinki Declaration, which was last revised in 2013.

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