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RESEARCH ARTICLE

An Evaluation of Risk Factors in Cases of Perinatal Asphyxia

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ABSTRACT

Aim: To determine the demographic characteristics of cases followed up with a diagnosis of perinatal asphyxia and to examine the risk factors in these cases.

Material and Method: This retrospective study included 81 cases diagnosed with perinatal asphyxia and applied with hypothermia therapy in the neonatal intensive care unit of a tertiary level hospital between June 2018 and January 2020. The demographic characteristics of the cases and data related to perinatal risk factors were collected from the patient files and were analyzed using SPSS software.

Results: When the pregnancy follow-up of the mothers was examined, 43.2% had attended antenatal examinations and 56.8% had not had regular follow-up. Delivery was by caesarean section in 24 (29.6%) cases and the normal spontaneous vaginal route in 57 (70.4%) cases. Risk factors determined before the birth were fetal bradycardia in 10 (10.1%) cases, pre-eclampsia in 5 (5.1%) cases, and gestational diabetes mellitus in 7 (7.1%) cases. Birth complications were recorded as prolonged difficult labour in 42 (42.4%) cases, cord prolapse in 7 (7.1%), abruptio placentae in 6 (6.1%) and amniotic fluid with meconium in 7 (7.1%) cases. No risk factors for perinatal asphyxia were determined in 4 (4.0%) cases.

Conclusion: Perinatal asphyxia was observed at a higher rate in male gender infants and perinatal asphyxia was determined to develop more often in the infants of mothers who had not had antenatal follow-up. Of the known risk factors in the antenatal period and during the birth, difficult labour was observed at the highest rate.

Keywords: asphyxia, newborn, risk factors

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INTRODUCTION

Perinatal asphyxia (PA), which is the most important cause of neurological morbidity seen in term and preterm infants, is a serious clinical condition with a mortality rate as high as 35% [1]. The 3 leading causes of neonatal deaths worldwide are preterm births, severe infections and perinatal asphyxia [2]. PA occurs because of arterial hypoxemia, hypercarbia and metabolic acidosis associated with impaired pulmonary ventilation due to low placental oxygen exchange capacity or postnatal events. While the prognosis for infants with mild asphyxia is good, severe asphyxia is associated with high morbidity and mortality. Approximately one-third of infants affected by moderate and severe encephalopathy develop mortality in the neonatal period [3-5].

Despite technological advances and developments in neonatal care together with obstetric practices, PA continues to be a significant cause of neonatal morbidity and mortality in developing countries [6,7]. There is great variability in the values reported of the frequency of PA because of differences in the diagnostic criteria [8]. PA has been reported at a frequency of 2-9/1000 live births [9-11]. The development of PA is particularly increased in premature births, pre-eclampsia, cephalopelvic incompatibility, breech presentation, prolonged labour, and conditions accompanying fetal distress [12].

The aim of this study was to investigate the demographic characteristics of cases

followed up in our clinic for a diagnosis of PA and to determine the risk factors.

Material and Method

This study was conducted in the Neonatology Clinic of Harran University School of Medicine (a level III neonatal intensive care unit) in Sanliurfa, Turkey, between June 2018 and January 2020. Before the study, written informed consent was obtained from the patients included in the research. This study conformed to the principles of the 2008 Declaration of Helsinki and was approved by the Ethics Committee of Harran University School of Medicine (Approval date: 11.05.2020, Session: 09, Decision:07). The study included 81 cases with moderate and severe findings of encephalopathy in clinical evaluation who were applied with hypothermia treatment.

The patients included were those with gestational age (GA) ≥36 weeks, birth weight (BW) >2000 gr, blood gas values of pH ≤7 or base deficit >16 mmol/L in the cord blood gas or within the first postnatal hour, a 10-min APGAR score <5 or with a continuing need for resuscitation, and demonstrating intermediate or severe encephalopathy findings according to the modified Sarnat and Sarnat criteria in the clinical evaluation.

Patients were excluded from the study if GA was <36 weeks, > 6 hours postnatal, BW <2000 gr, if they had a congenital metabolic disease, a sibling history with other diseases in the family seen with early encephalopathy and diagnosed with energy deficiency, those with very severe or widespread cranial parenchymal bleeding, life-threatening coagulopathy, maternal history of chorioamnionitis, or those with trisomies or multiple organ anomalies (13, 14).

All patients diagnosed with perinatal asphyxia were given therapeutic hypothermia (TH) therapy. The TH was applied using the Arctic Sun® 5000 Temperature Management System as servo-controlled whole body cooling with a rectal temperature probe targeting a rectal temperature of 33.5°C. After 72 hours of cooling, 7 hours of re-warming was applied (maximum temperature rise of 0.5 ° C / hour) and the session was finished when the body temperature reached 36.5°C.

Blood Sampling and Analysis

A fetal blood sample of 2cc was taken from the umbilical artery of all the cases with a syringe washed with heparin into an anerobic environment for blood gas assays. After taking the sample, the needle tip was bent and covered with a plastic cap to prevent contact of the fetal blood with oxygen. Blood gas parameters were determined in the first 30 minutes under cold chain conditions using a blood gas analyzer (Abbott Point of Care Inc. Princeton, NJ, USA).

Statistical Analysis

Data obtained in the study were analysed statistically using SPSS vn. 24.0 software (SPSS Inc., Chicago, IL, USA). Descriptive statistics were stated as mean±standard deviation, number (n) and percentage (%).

Table 1. Evaluation of the infants according to number of pregnancies, type of birth, parental consanguinity, and antenatal follow-up

		No of Cases (N)	%
Number of pregnancies	1st pregnancy	32	39.5
	≥2nd pregnancy	49	60.5
Type of birth	C/S	24	29.6
	SVD	57	70.4
Parental consanguinity	Yes	16	19.8
	No	65	80.2
Antenatal follow-up	Yes	35	43.2
	No	46	56.8

C/S: caesarean section, SVD: Spontaneous vaginal delivery

RESULTS

Evaluation was made of 81 cases followed up with a diagnosis of PA in the neonatal intensive care unit. The cases comprised 52 (64.2%) males and 29 (35.8%) females with mean GA of 38 ± 1.26 weeks and mean BW of 3193 ± 467 gr. The birth was preterm in 20 cases and term in 61 cases. Delivery was by caesarean section (C/S) in 24 (29.6%) cases and the normal spontaneous vaginal route in 57 (70.4%) cases. There was parental consanguinity in 16 (19.8%) cases and not in 65 (80.2%). When the pregnancy follow-up of the mothers was examined, 35 (43.2%) had attended antenatal examinations and 46 (56.8%) had not had regular follow-up. In 32 (39.5%) cases, this was the first birth and in 49 (60.5%) it was the ≥2nd birth (**Table 1**).

When the antenal risk factors and those associated with the birth were examined, fetal bradycardia, pre-eclampsia-eclampsia and gestational diabetes were determined as the most frequently seen antenatal risk factors, and prolonged difficult birth was the most common risk factor related to the birth. The analysis of all the risk factors is shown in **Table 2**.

The data of 81 patients who were followed up and treated with the diagnosis of perinatal asphyxia in the neonatal intensive care unit were evaluated. Mortality developed in six cases of perinatal asphyxia.

DISCUSSION

Despite all the developments in neonatal care, diagnosis and treatment, PA remains one of the most important causes of morbidity and mortality in newborns, even in developed countries [15]. With the diagnosis of the risk factors in PA, taking the necessary precautions and the implementation of appropriate antenatal, natal and postnatal care, a decrease can be obtained in asphytic infants and the associated complications. The cases in the current study comprised 20 preterm and 61 term births. All the cases included in the study had moderate or severe findings of encephalopathy and were applied with hypothermia treatment. The mean GA was 38±1.26 weeks and mean BW was 3193±467 gr. In a study by Gül et al, [16] which examined PA risk factors, 130

Table 2. Risk factors before and during the birth in perinatal asphyxia cases

RISK FACTOR	No of Cases (N)	%
Antenatal Risk Factors		
Pre-eclampsia-eclampsia	5	5.1
Gestational Diabetes Mellitus	7	7.1
Oligohydramnios	3	3.0
Maternal hypotension	3	3.0
Placenta previa	1	1.0
Fetal bradycardia	10	10.1
Birth-related problems		
Cord Prolapse	7	7.1
Enwrapped cord	2	2.0
Amniotic fluid with meconium	7	7.1
Abruptio placentae	6	6.1
Prolonged difficult birth	42	42.4
Unknown	4	4.0
TOTAL	***97***	***100***

Multiple responses were given to Risk Factors. Ratios are based on these values

(44%) cases were preterm, 147 (50%) were term and 18 (6%) were post-term according to GA, 50 (16.9%) had BW of <1500gr, and 200 (67.8%) were determined with BW>2000 gr. Ibrahim et al, [17] evaluated 235 asphyxia cases and reported BW of >2500gr in 57% of cases. In the current study, 64.2% of the infants were male. In the study by Gül et al, [16] there were 179 (61%) males and 116 (39%) females, and Johnston et al, [18] reported a hgher rate of cerebral palsy associated with PA in males. The gender distribution of the current study was observed to be consistent with previous studies.

With the international opinions and encouragement supporting normal birth widely found in literature, the insistence of obstetricians on normal vaginal delivery in some cases may increase the incidence of perinatal asphyxia [19]. In the current study, there were 24 (29.6%) cases of C/S and a significantly higher rate of normal births at 57 (70.4%) cases. Gül et al, [16] reported caesarean deliveries at 39%, spontaneous vaginal birth at 53.6%, and vaginal delivery using forceps-vacuum at 7.4%. In another study by Mbweza et al, [12] caesarean delivery of asphyxia cases was reported as 18% and the use of vacuum/forceps as 16%. In the current study, vacuum or forceps were not used in any case. The application of C/S without delay is critical to reduce exposure of the infant to stress and asphyxia in a prolonged or difficult labour.

Antenatal follow-up throughout the pregnancy is extremely important in respect of risks that may be encountered and of guidance for the birth. In the evaluation of the antenatal follow-up of the mothers in the currrent study, it was seen that 35 (43.2%) attended antenatal follow-up and 46 (56.8%) did not. In a 2008 study by the Turkish Neonatology Association Hypoxic Ischaemic Encephalopathy Working Group, 85% of the mothers attended antenatal follow-up, and 14.9% were determined to have completed the pregnancy without monitoring [20]. In the region where the current study was conducted, it is known that in cases of maternal death, a sufficient level of the necessary follow-up could not be applied regularly throughout the pregnancy. This can be attributed to socio-economic problems, low level of maternal education, increased gravida and a greater number of seasonal workers than in other provinces.

As 90% of PA cases develop associated with intrauterine and intrapartum events, evaluation of the fetal status is very important. The aim of intrapartum fetal surveillance is to determine the decompensation potential in the fetus to prevent PA and hypoxic ischaemic encephalopathy which will result in perinatal morbidity and mortality, thereby preventing stillbirths and neonatal deaths in a timely and effective way [21]. In the current study cases treated for a diagnosis of PA, the most frequently seen known antenatal risk factors were fetal bradycardia, gestational diabetes mellitus, pre-eclampsia-eclampsia, maternal hypotension, and oligohydramniosis. The risk factors associated with the birth were determined as cord prolapse, amniotic fluid with meconium, abruptio placentae and prolonged difficult birth. In 4 (4.0%) cases, no PA risk factors were determined. Consistent with the findings of the current study, the 2008 study by the Turkish Neonatology Association Hypoxic Ischaemic Encephalopathy Working Group, reported that intrapartum asphyxia in 29% of cases was caused by conditions such as placenta detachment, enwrapped cord , oligohydramniosis, extended membrane rupture, multiple pregnancy, abnormal presentation and the use of forceps or vacuum [20].

In a study by Wu et al, [6] the frequency of risk factors for infants >2000gr was determined respectively as emergency C/S, congenital anomalies, enwrapped cord , large for gestational age infant, maternal infection and multiple pregnancy. Mbweza et al, [12] examined the maternal risk factors of PA and reported premature birth, pre-eclampsia, cephalopelvic incompatability, breech presentation prolonged labour and events accompanying fetal distress. In a prospective study of 961 asphytic infants, Kolatat et al, [22] found the most important risk factors to be abnormal fetal heartrate, amniotic fluid with meconium and premature birth. The risk factors in the current study were observed to be similar to those in other studies in literature. The differences seen in the rates from country to country are most likely due to the differences in levels of healthcare services given in the perinatal period.

In conclusion, perinatal asphyxia was determined to develop more often in the infants of mothers who had not had antenatal follow-up. Of the known risk factors in the

antenatal period and during birth, difficult labour was observed at the highest rate. To reduce the frequency of asphyxia and associated perinatal mortality, effective obstetric precautions must be taken for the determination and prevention of fetal stress. It must be emphasised again that sufficient antenatal care must be given to high-risk pregnancies, at all births there must be sufficient trained personnel who can make the necessary interventions and resuscitate newborns, and especially at the time of delivery, stress to which the infant is exposed must be reduced without any delay.

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