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Original Article

Comparison of the Incidence of Perinatal Asphyxia before and after the Health Improvement Program in Bentolhoda Hospital of Bojnurd, Iran

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ABSTRACT

***Background*:** Perinatal asphyxia is a common cause of infant morbidity and mortality and long-term neurological disabilities. Due to the high costs of admission, a large proportion of births and neonatal deaths occur in non-hospital settings. This study aimed to evaluate the incidence rate of perinatal asphyxia before and after the implementation of the health improvement program.

***Methods*:** This descriptive-analytical study was conducted on all the infants with moderate and severe asphyxia during April 2013-2015. Subjects were divided into two groups of A and B (born after and before the health improvement program, respectively). Maternal and neonatal data were recorded in checklists and compared between these groups. Data analysis was performed in SPSS version 17.

***Results*:** In total, 111 asphyxiated neonates were classified into two groups of A and B, and incidence rate of asphyxia was estimated at 0.54% and 1.05%, respectively. Severe asphyxia was observed in 35.7% and 28.9% of the infants in groups A and B, respectively. Moreover, mean duration of mechanical ventilation was 25 and 79 hours in groups A and B, respectively.

Conclusion: According to the results of this study, implementation of the health improvement program reduced the incidence of perinatal asphyxia. In addition, number of cesarean cases due to previous C-section was observed to decrease. Therefore, it could be concluded that high-quality resuscitation efforts and restricted rules in the health improvement program lower the risk of long-term complications in asphyxiated neonates. However, no significant difference was observed in the mortality rate of the asphyxiated newborns in this study.

Keywords: Asphyxia, Health improvement program, Newborn

Introduction

Perinatal asphyxia is a common cause of morbidity and mortality during the neonatal period, as well as long-term neurological disabilities (1). According to statistics, 2-4 cases per 1,000 full-term neonates suffer from asphyxia upon or shortly after birth (2). Perinatal asphyxia is defined as the severe reduction of oxygen delivery in the perinatal period, which may lead to hypoxemia, hypercapnia and metabolic acidosis (3). A recent review in this regard has suggested that asphyxia might primarily be of antepartum origin in 50% of the cases, intrapartum in 40%, and postpartum in 10% of the cases (4).

Incidence of antenatal and intrapartum asphyxia has been reported to be higher in complicated pregnancies, especially those associated with diminished placental reserve, such as preeclampsia, intrauterine growth restriction, placental abruption, fetal anemia, postmaturity, unphysiological labor and malpresentation (5).

Statistics suggest that 18-23% of all newborn deaths are caused by perinatal asphyxia, which accounts for a large proportion of stillbirths (6). Following the advancement in the primary and obstetric care in developmental countries, incidence rate of birth asphyxia has reduced significantly, and less than 0.1% of neonates are reported to die due to this disease (7). However, prevalence of perinatal asphyxia in developing countries is remarkably

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higher, as estimated at 4.6 cases per 1,000 births in Cape Town (South Africa) and 7-26 cases per 1,000 births in Nigeria. Furthermore, mortality rate of this disease was reported to be 40% or higher (8).

According to the World Health Organization (WHO), birth asphyxia affects 4-9 million infants each year. Among these cases, approximately 1.2 million die, while an equal proportion develop severe complications, such as epilepsy, cerebral palsy and developmental delay (9). Severe complications in labor and lack of access to skilled care during delivery are the main intrapartum causes of the high prevalence of birth asphyxia in developing countries (10, 11). In many of these countries, a large proportion of births and neonatal deaths occur in non-hospital settings. However, accurate epidemiological data are scarce regarding the burden of severe neurological disabilities associated with perinatal asphyxia in developing countries, and reliable studies are not available in this regard (12).

Prevention of perinatal asphyxia in neonates is possible through the appropriate obstetric monitoring of pregnancy and labor for the risk factors of this disease, adequate resuscitation efforts for infants and follow-up examinations. Additionally, acquisition of relevant data (e.g., Apgar scores, umbilical cord and blood gas values) and infant monitoring are of paramount importance in the prevention of perinatal asphyxia. However, these data cannot accurately predict the long-term outcomes of this disease.

This study aimed to evaluate the incidence rate of perinatal asphyxia, review the other predictors of birth asphyxia and compare these events before and after the implementation of the health improvement program, as proposed by the Ministry of Health in North Khorasan University of Medical Sciences, Iran. This program was initiated in 2014 with the purpose of reducing the rate of births in non-hospital settings by offering free health services.

Methods

This descriptive-analytical study was conducted during April 2013-2015 on all the neonates with moderate and severe perinatal asphyxia, who had been born within one year before and after the beginning of the health improvement program. Study protocol was approved by the Ethics Committee of Bojnurd University of Medical Sciences, Iran.

A neonatologist collected and recorded the maternal and neonatal data, perinatal history, and clinical and laboratory findings of the subjects. Data collection was performed through reviewing the medical records of the newborns diagnosed with perinatal asphyxia.

In this study, perinatal asphyxia was confirmed in the presence of at least two of the following conditions: signs of fetal distress, meconium-stained amniotic fluid or non-vigorous state, one- and five-minute Apgar scores of ≤6, need for resuscitation for more than one minute with positive-pressure ventilation and oxygen immediately after birth, blood pH of <7.25 or a minimum base deficit of 12 within the first hour after birth.

In total, 125 eligible infants were enrolled in this study, 14 of whom were excluded due to incomplete data (n=6), clinical chorioamnionitis (n=3), nonimmune hydrops (n=2), and congenital malformations (n=3). Infants were allocated to two groups of A and B (born within one year after and before the health improvement program, respectively).

Maternal and neonatal data were recorded in prepared checklists, including maternal age and parity, mode of delivery, cause of cesarean section, Apgar scores, resuscitation efforts, clinical evidence of moderate or severe asphyxia (e.g., seizure), length of intubation and hospitalization, laboratory tests (e.g., arterial blood gas analysis) and death or discharge from the hospital. Collected data were compared between the two groups.

Data analysis was performed in SPSS version 17 using Student's t-test and Chi-square to evaluate the quantitative and qualitative variables, respectively. In this study, P value of less than 0.05 was considered statistically significant.

Results

In total, 111 asphyxiated neonates were enrolled in this study and categorized into groups A (n=23) (born after the health improvement program) and B (n=88) (born before the health improvement program). Mean maternal age in groups A and B was 27.1 and 26.9 years, respectively. Frequency of cesarean section was 44.4% and 41.7% in groups A and B, respectively, and no significant difference was observed between the groups in terms of the mode of delivery (P=0.828) (Figure 1).

According to our findings, the most common cause of cesarean section was meconium-stained amniotic fluid in groups A (25%) and B (20%). Other causes of C-section included fetal distress (severe

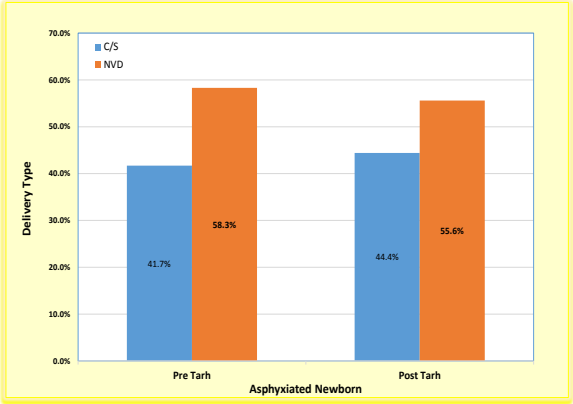

Figure 1. Mode of delivery in study groups

decolman), previous cesarean section and fetal bradycardia. In this study, rate of cesarean section due to previous C-section significantly decreased in the mothers of group A (8.3%) compared to group B (15%) (Table 1).

Table 1. Causes of C-section in study groups

Cause of cesarean section	Group A (%)	Group B (%)
Meconium aspiration syndrome	25	20
Decolman	25	12.5
Multigestational pregnancy	25	2.5
Sufferance	8.3	17.5
Previous C-section	8.3	15
Placenta previa	8.3	2.5
Non-progress	0	12.5
Breech	0	5
Elective C-section	0	5
Preeclampsia/eclampsia	0	7.5

Findings of this study were indicative of no significant difference between the two groups in terms of birth weight, one- and five-minute Apgar scores, and pH and PCo_2 values in the arterial blood gas analysis. On the other hand, advanced resuscitation (e.g., intubation) was more frequent among the asphyxiated newborns in group A (67%) compared to group B (51.5%) (P=0.11) (Table 2).

Incidence rate of severe asphyxia was estimated at 35.7% and 28.9% in groups A and B, respectively, which denotes no significant difference between the groups (P=0.318). Moreover, mean duration of mechanical ventilation was 25 and 79 hours in groups A and B, respectively (P=0.11)

In this study, groups A (7.1%) and B (7.2%) had no significant difference in terms of mortality rate (P=0.989). However, one-year follow-up of the subjects indicated that 14.8% of the neonates in group A and 7.3% of the asphyxiated infants in groups B developed consequences such as seizure, spasticity and developmental delay (P=0.225).

According to the hospital data (e.g., total birth values) during the study period, incidence rate of asphyxia was 0.54% and 1.05% after and before the health improvement program, respectively.

Table 2. Comparison of different variables in study groups

Variables	Group A	Group B	P-value
Mean gestational age (week)	36.67	36.65	0.982
Mean birth weight (g)	2718	2786	0.678
Mode of delivery (C-section) (%)	44.4	41.7	0.828
Primary Grave's disease (%)	50	40	0.486
One-minute Apgar score	5.9	6.5	0.380
Blood pH	7.22	7.17	0.070
Blood PCo_2	45	50	0.219
Need for positive pressure ventilation (%)	66.7	51.5	0.193
Mechanical ventilation (%)	32.3	24.7	0.460
Duration of mechanical ventilation (hour)	25	79	0.112
Seizure (%)	28.6	17.5	0.282
Mortality (%)	7.1	7.2	0.989

Discussion

According to the results of the present study, incidence of perinatal asphyxia significantly reduced after the implementation of the health improvement program (0.54% versus 1.05%). Furthermore, total number of asphyxiated infants (moderate and severe) declined by half after this project. These findings are suggestive of the efficacy of the health improvement program in decreasing the rate of birth asphyxia through diminishing the proportion of births and neonatal deaths in non-hospital settings by offering free health services.

Although the rate of cesarean section showed no significant reduction after the health improvement program, rate of C-sections due to previous cesarean delivery was found to decrease in the current study. We believed that restricted rules for free payment for this type of delivery caused reduction number of c/s due to previous c/s.

According to the results of the present study, meconium staining of the amniotic fluid was the main cause of cesarean section, whereas previous C-section has been reported as the main cause of this mode of delivery in other studies (8, 9, 13).

Despite the higher incidence rate of severe asphyxia in the neonates born after the health improvement program, our findings were indicative of the reduced mean duration of mechanical ventilation (25 and 79 hours in groups A and B, respectively). This could be due to the advancement

of resuscitation equipment in hospitals as a positive outcome of the health improvement program.

In the current study, no significant difference was observed in the mortality values of asphyxiated newborns before and after the health improvement program. However, long-term complications (e.g., seizure, developmental delay and spasticity) showed a slight decrease after the initiation of the health improvement program (14.8% versus 7.3%). According to the WHO, approximately 13.3% of asphyxiated neonates develop severe consequences (e.g., epilepsy, cerebral palsy and developmental delay), which is consistent with the results of the current research (9).

Conclusion

According to the results of this study, the health improvement program could reduce the incidence of perinatal asphyxia and rate of cesarean section due to previous C-section. Moreover, higher quality of resuscitation efforts and restricted rules of this project could prevent the long-term complications caused by birth asphyxia. In this study, no significant difference was observed in the mortality values of asphyxiated newborns before and after the implementation of the health improvement program. Therefore, it is recommended that further investigation be conducted for the recognition of the exact effects of this program on perinatal asphyxia.

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Conflicts of interests

No

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