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Original Research Article

Study of relationship between umbilical cord blood hemoglobin percentage and perinatal asphyxia

Sambedna[1], Amit Kumar[2]*, Rita Chakore[3]

[1]Department of Obstetrics and Gynecology, [2]Department of Pediatric Surgery, AIIMS, Patna, Bihar, India
[3]Department of Obstetrics and Gynecology, PMCH, Patna, Bihar, India

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***Correspondence:**
Dr. Amit Kumar,
E-mail: amitsandilya1981@gmail.com

ABSTRACT

Background: Perinatal asphyxia may be caused by perinatal anemia. The pathophysiology and neurodevelopment effects are theoretically different from other causes of fetal asphyxia. Severe asphyxia can occur in infants around the time of birth by various reasons. The aim of this study to find the relationship between cord blood hemoglobin and perinatal asphyxia.
Methods: This was a retrospective comparative study in department of OBG In tertiary care health centre. Umbilical cord blood samples were collected from 100 newborns with asphyxia at birth as study group and 100 newborns with non asphyxia as control group. Hemoglobin was measured colorimetrically.
Results: This study finds that maximum number of patients in both the control and study group had hemoglobin in the range of 16.3-17.3 gm/dl. The difference was not statistically significant. P value>0.05.
Conclusions: Hematological changes observed early after delivery can determine the duration of hypoxemia (acute versus chronic) Perinatal anemia causing moderate to severe perinatal asphyxia is associated with a higher risk for neonatal mortality. All survivors with perinatal anemia, however, showed no abnormalities in neurodevelopment in contrast to children who were born asphyxiated due to various another causes. The underlying pathophysiological mechanism for the favorable NDO in the perinatal anemia group needs further elucidation.

Keywords: Fetal asphyxia, Neurodevelopmental outcome, Umbilical cord blood haemoglobin

INTRODUCTION

Perinatal asphyxia should be exclusively used to indicate those infants who have metabolic acidosis and hypoxia at birth. There are various maternal and fetal factor which causes perinatal asphyxia. Out of which one important maternal factor that may affect the occurrence of asphyxia in newborns is maternal blood chemistry such as increase or decrease in hemoglobin levels, hematocrit, and thrombocyte, which cause impaired uteroplacental blood circulation so that the supply of oxygen to the baby decreased resulting in baby hypoxia in the uterus and may progress to asphyxia in newborns. The assessment of therapeutic strategy and duration of asphyxia depends upon hematological changes observed early after delivery.

Changes in the hemopoietic system can be observed as complications of asphyxia. Altered biophysical characteristics of blood, e.g. changes in the structure and function of erythrocytes, leukocytes and thrombocytes can be caused be asphyxia.[1,2] There are various parameter described in literature to diagnose perinatal asphyxia like umbilical cord blood pH estimation, meconium stained amniotic fluid, Apgar score and fetal heart rate changes. The objective of the study is to find the relationship between cord blood hemoglobin and perinatal asphyxia. Estimation of hemoglobin is a relatively cost-effective and widely available investigation.

METHODS

This was a retrospective comparative study of cord blood hemoglobin percentage in asphyxiated and non asphyxiated baby in a tertiary level health care centre conducted between December 2013 and November 2015. Umbilical cord blood were collected from 100 newborn with asphyxia at birth and equal number of normal appropriately matched 100 newborn without asphyxia to study hemoglobin percentage in cord blood sample. The sample size was calculated based on prevalence of neonatal hypoxia and odds ratio.[3]

Ethical clearance of the study was taken, vide letter number PMC/2013/2226. Informed consent was obtained for every patient. Patients in both case and control group were selected from labour room, patient. These were the patients who were having singleton pregnancy and were in labour between 37 to 42 weeks of gestation.

Inclusion criteria

Thick meconium stained amniotic fluid; non reassuring fetal heart rate pattern; low Apgar score ≤6 at 5 minutes of birth (followed up in NICU).

Exclusion criteria

Infants with condition (baby born physical disability, premature baby, baby gamelli); placenta previa marginalis, placental abruption; cord coil; pregnancy (infection, preeclampsia/ eclampsia); and birth process (APB, bleeding, prolonged labor)

From all the subjects, cord bloods were collected immediately after clamping and cutting the umbilical cord. Sample was taken and hemoglobin percentage was measured in both case and control group by colorimetrically.

Statistical analysis

Statistical analysis was done using SPSS (software statistical package for social science) version 16 and chi square test.

RESULTS

The study included 100 patient in study (asphyxiated baby) and 100 patients in control group (non asphyxiated) for this analysis.

Table 1 shows age of the patients in the study group ranged from 16 to 35 years and in the control group ranged from 16-30 years. Maximum number of patients were in 21-15 years age group both in case as well as control group. Mean age of patients in the study group was 22.42 years. Mean age of patients in the control group was 21.98 years.

Table 1: Age distribution of patients.

Interval	No. of patients in study group	No. of patients in control group
16-20 years	29	32
21-25 years	55	57
26-30 years	15	11
31-35 years	1	0
Mean value (average)	22.42 years SD- 2.81	21.98 years SD- 0.73

P value >0.05

Table 2 shows hemoglobin percentage in both control and study group. P value >0.05 Maximum number of patients in both the control and study group had hemoglobin in the range of 16.3-17.3 gm/dl.

Table 2: Hemoglobin percentage of cord blood in asphyxiated versus non asphyxiated babies.

Hb% (gm/dl)	No. of patients in study group/ asphyxiated babies	No. of patients in control group/ non asphyxiated babies
<15.3 gm/dl	5 (5%)	11 (11%)
15.3-16.3 gm/dl	26 (26%)	20 (20%)
16.3-17.3 gm/dl	56 (56%)	52 (52%)
>17.3 gm/dl	13 (13%)	17 (17%)

DISCUSSION

We presumed that perinatal anemia was caused by intensification of oxidative stress during prenatal and direct postnatal period, as well as by blood redistribution or by haemorrhage. In the asphyxia, the increased production of erythropoietin increases the amount of nucleated erythrocytes, from which the non-nucleated cells matured gradually The presence of nucleated erythrocytes in umbilical blood confirms the presence of an asphyxia event during intrauterine development.[1,2] An increased amount of nucleated erythrocytes is the consequence of chronic intrauterine asphyxia.[4,5] One important study on asphyxia concluded in the first 96 hours of life increased peripheral leukocyte counts may contribute to abnormal neurodevelopment outcome.[6] In our study we only focused on hemoglobin percentage with perinatal asphyxia because we can only assume that the asphyxia in our group of patients was of too short duration and low severity to produce changes observed by Morkos et al. However in acute onset asphyxia, another physiological adaptation mechanism is there. This mechanism, activated by asphyxia, consists in shunting blood from the skin and splanchnic area to the heart, adrenals, and brain. This recirculation of blood protects these vital organs from hypoxic-ischemic injury. In this study, maximum number of patients in the study group and the control group were of age group 21-25 years 55% patient in the study group and 57% patients in the control group were in this age group. Beside these,

29% patients in the study group were in the age group of 16-20 years.

The mean age of the study group of patients was 22.42±2.81 years whereas the mean age of the patients in the control group was 21.98±0.73 years. The difference was not statistically significant (p>0.05). In the study by Ghosh et al of AIIMS in 1999-2001, the mean maternal age of the study group was 27.19±3.82 years and of the control group was 26.73±4.40 years.[7] Here also the difference was not statistically significant (p=0.66). Qaiser et al of Ziauddin University, Pakistan in 2006-2008 studied the influence of maternal factors on the hematological parameters of healthy newborns. They found that NRBC count/100 WBC and other hematologic parameters in women of age group 15-27 years were not statistically different from that in the age group of 28-45 years (p=0.07).[8]

In the study by Boskabadi et al in 2006-2008, the difference in the mean age of patients having evidence of perinatal asphyxia and patients not having perinatal asphyxia was statistically not significant.[9]

In our present study the case and the control group were comparable on the basis of age and thus any possible effect of maternal age on the haemoglobin percentage cord blood may be neglected. In this study among the 100 patients in the study group and 100 patients in the control group maximum patients (56% of study group and 52% of control group) had cord blood hemoglobin in range of 16.3-17.3 gm/dl. P value was >0.05 which means there was statistically no significant difference between two groups. In previous studies like a study by Alam et al of AMU, Aligarh, India found the mean±SD in control group was 17.33±1.65 and in study group in acute fetal distress mean ±SD is 16.45± 2.57 and in chronic fetal distress mean±SD is 16.43±3.03 (p value >0.05).[10] The difference was not statistically significant. Another study by Puri et al mean hemoglobin was 14.84±2.18 gm/dl in study group and in control group it was 14.51±1.70 gm/dl. No significant difference was found on basis of hemoglobin concentration (p value =0.418).[11] There are various studies which concluded that Hb% had significant relationship with perinatal asphyxia. One such type of study of Darkhaneh et al was concluded that the mean hemoglobin and absolute nucleated red blood cell count of study group was significantly higher than the control group. The Hb% of study group was14.37±1.89 and Hb% of control group was 14.03±1.71. The p value obtained was 0.049, which means it was significant.[12] Another study which also supports the significant relationship between hemoglobin percentage and perinatal asphyxia was observed by brucknerova et al who found that in first day of life hemoglobin percentage in study group was 160.66±5.4 and in control group was 187.13±5.88.[13] In 5th day of life hemoglobin percentage in study group was 147.09±5.03 and in control group was 178.80±5.28. P value was <0.05, which means it was significant. This study showed that a non-significant relationship between hemoglobin percentage and fetal asphyxia in compare to Darkhaneh et al and Brucknerova et al, the cause behind it may be the smaller sample size.[13] This needs further debate and research.

The aim of current perinatology research is finding and determining the most sensitive, easily obtainable and fast assessable parameter to detect and quantify asphyxia. The newborns have inadequate antioxidant protection and oxidative stress is a major cause of irreversible CNS damage in term asphyxia newborns. Studies have confirmed the helpful effects of antioxidant supplementation during hypoxemia.[14-18]

CONCLUSION

The duration of chronicity or acuteness of fetal asphyxia can be determined by hematological changes observed early after delivery. Perinatal anemia results moderate to severe perinatal asphyxia may be associated with a higher risk for neonatal mortality. Asphyxiated baby who survived and born with perinatal anemia, however, showed a normal NDO in contrast to children who were born asphyxiated due to other causes. The underlying pathophysiological mechanism for the favorable NDO in the perinatal anemia group needs further elucidation. In spite of the recent decrease of perinatal morbidity and mortality, the risk of pre/postnatal CNS damage as a consequence of asphyxia did not decrease. Interest to work in this field was motivated by the fact, that in developing countries, there are inadequate facilities at the peripheral health centers to measure cord blood or fetal scalp pH, which best confirms the acidosis in cord blood, so this study focuses on the level of cord blood hemoglobin and its relationship with perinatal asphyxia. Although no significant relationship was established in the index study it is recommended that a study with a larger sample size may lead to a more significant outcomes in futures studies.

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