

Original Research Article

Evaluation of risk factors for perinatal asphyxia in a tertiary care hospital in Bangalore: an observational prospective study

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ABSTRACT

Background: Perinatal asphyxia is an insult to fetus or newborn due to lack of oxygen (hypoxia) or lack of perfusion (ischemia) to various organs of sufficient magnitude and duration. Prenatal asphyxia is one of the major causes of early neonatal mortality in India. Our goal was to evaluate risk factors of perinatal asphyxia.

Methods: Observational prospective study on 100 babies delivered in our hospital consecutively and requiring resuscitation were included.

Results: The mean age of mothers was 23.5 years. 54% neonates were born to primiparous mothers. Anaemia was widely prevalent in the mothers of neonates requiring resuscitation. The major maternal risk factors for newborns requiring resuscitation were pregnancy-induced hypertension (PIH) (46%), oligohydramnios (41%), polyhydramnios (30%) and meconium stained liquor (28%). The fetal factors associated with resuscitation of newborns were intrauterine growth restriction (IUGR) (30%), prematurity (25%), meconium aspiration syndrome (MAS) (20%), and neonatal seizures (36%). Mortality was highest in hypoxic ischemic encephalopathy (HIE) stage 3 with 11%.

Conclusions: The most common maternal risk factors for newborns requiring resuscitation was PIH followed by oligohydramnios, polyhydramnios and meconium stained liquor. IUGR was the most common fetal risk factor followed by, prematurity, MAS and neonatal seizures.

Keywords: Perinatal asphyxia, Prematurity, Seizures, PIH, IUGR

INTRODUCTION

"The measure of a civilization is how it treats its weakest members," said Mahatma Gandhi. Undoubtedly, newborns are the weakest members of our society. India is the epicentre of world's neonatal mortality with every fourth dying newborn of the world being Indian.^{1,2} Preterm birth complications (34%), infections (21%), and birth asphyxia (24%) are the three topmost causes of neonatal mortality worldwide.¹ Mortality risk is highest on the first day of life contributing up to 36% of all neonatal deaths – most of these due to birth asphyxia.¹

Birth asphyxia, although the correct definition is imprecise, is an insult to the fetus or newborn due to failure to breathe or breathing poorly leading to decrease oxygen

perfusion to various organs. According to a survey conducted by WHO in 2005, it is also one of the leading causes of neonatal deaths within first week of life.³

Worldwide more than one million children surviving birth asphyxia annually go onto suffer its long-term consequences – cerebral palsy, learning disorders and other disabilities.⁴ This creates a great burden for the family as well as for the society. This is a preventable condition in a developing country like India.

On the brighter side, birth asphyxia operates mainly in the first few minutes immediately after birth, and hence, unlike the other two causes, provides a narrow but definite window of opportunity. If appropriate actions are taken – essentially the first golden minute of life – a big load of

neonatal mortality is largely preventable. These simple steps can be learnt by any healthcare personnel, and are sufficient to manage almost 99% of newborns as advanced resuscitative measures like chest compression and medications are known to be required in hardly 1% of the births.⁵ Various materno-fetal risk factors are involved in perinatal asphyxia. Singh et al had found the association of one or more high risk materno-fetal factors of birth asphyxia.⁶

World Health Organization defined birth asphyxia as “the failure to initiate and sustain breathing at birth. The exact definition of birth asphyxia is given by the American College of Obstetrician and Gynaecologists, which includes the following criteria (American College of Obstetricians and Gynaecologists et al 2003): metabolic or mixed acidosis (pH <7.00) in an arterial cord blood sample, Apgar score 0–3 for more than 5 min after birth, evidence of neurologic signs in the immediate neonatal period, and evidence of multiorgan failure in the immediate neonatal period.

Recognition of risk factors, results in identification of high-risk deliveries and attendance of the resuscitation team, before the baby is born. The prognosis and severity of the symptoms of child with birth asphyxia depends on the risk factors and management of the patient.^{7,8} The objective of this research was to study the risk factors of birth asphyxia in children requiring resuscitation.

METHODS

Place of study

The study was conducted in the Department of Paediatrics, Sathagiri Institute of Medical Sciences and Research centre, Bangalore.

Type of study

The type of study was an observational prospective study on babies delivered in our hospital and requiring active resuscitation.

Duration of study

The duration of the study was from January 2018 to March 2020.

Sample collection

Maternal obstetric history was taken which included the age, gravity, parity, abortions and living issues and was entered in the gravida, para, abortus and living (GPAL) format. Mother's ante natal care (ANC) status was recorded. Mother's ABO blood group and Rhesus (Rh) type was taken. Socioeconomic status was taken according to the modified Kuppuswamy scale and mothers were graded into 5 classes. Maternal health status and risk factors were noted. Neonatal information includes Birth

weight, term, preterm; appropriate for gestational age (AGA), small for gestational age (SGA), large for gestational age (LGA), and intrauterine growth restriction (IUGR) information were recorded.

Sampling methods

One hundred consecutive neonates with birth asphyxia during that period (Apgar 0-3 at 5-minute of age) were studied.

Inclusion criteria

Inclusion criteria included all newborns admitted or referred to our hospital with gestational age ≥ 28 weeks or birth weight ≥ 1000 grams and Apgar score less than 3 at 5 minutes.

Exclusion criteria

Neonates were excluded if they are suffering from major congenital anomalies or syndromes, e.g. anencephaly, cleftpalate with cleftlip, encephalocele, omphalocele, gastroschisis, and spina bifida, Mothers who took general anaesthesia, neonates less than 28 weeks, neonates less than 1000 grams.

Incomplete documentation (no maternal or fatal measurement parameters).

Operational definitions

- Perinatal asphyxia is the inability of the newborn to initiate and sustain adequate respiration after delivery.
- Apgar score is a score used as a part of early assessment of a newborn.
- Perinatal asphyxia is considered when the 5th min Apgar score is <3 or a neonate did not cry or needed resuscitation.
- Hypoxic ischemic encephalopathy (HIE) is a central nervous system dysfunction during the neonatal period and it is due to ischemic and hypoxic insult.
- Prolonged labour is the total duration of labour, >24 hours.
- Congenital malformation is a physical defect present in a newborn at birth that results in central nervous system depression.

Statistical analysis

The results obtained were tabulated and analyzed using appropriate statistical method.

RESULTS

The major maternal risk factors for newborns requiring resuscitation were PIH (46%), oligohydramnios (41%), polyhydramnios (30%) and meconium stained liquor (28%). The other risk factors include gestational diabetes

mellitus (20%), preterm premature rupture of the membranes (PROM) (18%), bleeding per vagina (PV) (17%), per partum pyrexia (16%), urinary tract infection (UTI) (12%), and eclampsia (9%). 2 mothers were smokers and other 2 were tobacco chewers. Anemia is widely prevalent and is seen in 70% of mothers. There were combination of risk factors among mothers as mentioned in Table 1.

Table 1: Distribution of maternal risk factors.

| Risk factor | N (%) |
|---------------------------------|-------|
| Anaemia | 65 |
| PIH | 46 |
| Oligohydramnios | 41 |
| Polyhydramnios | 30 |
| Meconium stained liquor | 28 |
| Gestational diabetes mellitus | 20 |
| PROM | 18 |
| Bleeding PV | 17 |
| Per partum pyrexia | 16 |
| UTI | 12 |
| Oligohydramnios+meconium liquor | 10 |
| Polyhydramnios+meconium liquor | 9 |
| Eclampsia | 9 |
| Multiple gestation | 7 |
| Tobacco chewing | 2 |
| Cord prolapse | 2 |
| Smoking | 2 |

Table 2 shows that of the 100 babies requiring resuscitation 9 were born to mothers who were unbooked.

Table 2: Distribution of antenatally booked status of mothers.

| Registration status | N (%) |
|---------------------|-----------|
| Booked | 91 |
| Unbooked | 9 |
| Total | 100 (100) |

Table 3 shows that male to female ratio is 1.5:1. Table 4 shows that we had 67 children with low birth weight requiring resuscitation. 15 were very low birth weight (VLBW) babies.

The fetal factors associated with resuscitation of newborns were IUGR (30%), prematurity (25%), meconium aspiration syndrome (MAS) (20%), neonatal seizures (36%), neonatal jaundice (32%), hypoglycaemia (27%), tachypnea of newborn (22%), apnea (12%), hypothermia and polycythemia both 7% and mal-presentation (3%) (Table 5).

According to American College of Obstetrician and Gynaecologists (ACOG), HIE staging was done. Mortality was highest in HIE stage 3 with 11% and comparable in HIE 1 and HIE 2 in our study (Table 6).

Table 3: Distribution of neonates according to their sex.

| Sex | N (%) |
|--------|-------|
| Male | 61 |
| Female | 39 |

Table 4: Distribution of neonates according to birth weight.

| Birth weight (kg) | N (%) |
|-------------------|-------|
| 1-1.4 | 15 |
| 1.5-2.49 | 52 |
| ≥2.5 | 33 |
| Total | 100 |

Table 5: Distribution of neonates according to fetal risk factors.

| Risk factor | N (%) |
|----------------------|-------|
| IUGR | 30 |
| Prematurity | 25 |
| AGA | 63 |
| SGA | 18 |
| LGA | 19 |
| MAS | 20 |
| Seizures | 36 |
| Neonatal jaundice | 32 |
| Hypoglycemia | 27 |
| Tachypnea of newborn | 22 |
| Apnea | 12 |
| Hypothermia | 7 |
| Polycythemia | 7 |
| Mal-presentation | 3 |

Table 6: Sarnat stage of HIE distribution of neonates and mortality (n=100).

| HIE status | N | Deaths (%) |
|------------|----|------------|
| HIE 1 | 38 | 5 |
| HIE 2 | 39 | 5 |
| HIE 3 | 33 | 11 |

DISCUSSION

Perinatal asphyxia, neonatal asphyxia or birth asphyxia is the medical condition resulting from deprivation of oxygen to a newborn infant that lasts long enough during the birth process to cause physical harm, usually to the brain. Hypoxic damage can occur to most of the infant's organs (heart, lungs, liver, gut, and kidneys), but brain damage is of most concern and perhaps the least likely to quickly or completely heal. In more pronounced cases, an infant will survive, but with damage to the brain manifested as either mental, such as developmental delay or intellectual disability, or physical, such as spasticity. It results most commonly from a drop in maternal blood pressure or some other substantial interference with blood

flow to the infant's brain during delivery.⁹⁻¹¹ This can occur due to inadequate circulation or perfusion, impaired respiratory effort, or inadequate ventilation. Perinatal asphyxia happens in 2 to 10 per 1000 newborns that are born at term, and more for those that are born prematurely.^{12,13} World Health Organization (WHO) estimates that 4 million neonatal deaths occur yearly due to birth asphyxia, representing 38% of deaths of children under 5 years of age. Fatalities from perinatal asphyxia remain high in developing countries, and continually assessing its risk factors will help improve outcomes in these settings.^{14,15}

We explored how some identified risk factors predict mortality in asphyxiated newborns, to assist clinicians in prioritizing interventions. This was almost a 2-year observational study conducted at the Sathagiri Institute of Medical Sciences and Research centre. All newborns who met the study criteria that were admitted in this period were enrolled and monitored. Data collected were analysed. A total of 100 newborns with perinatal asphyxia were enrolled into the study. Most of the population was from the lower, lower middle and upper lower socioeconomic status according to modified Kuppuswamy classification.

54% neonates were born to primiparous mothers. According to our study, the mean age of mothers was 23.5 years. Study indicated that young maternal age (20-25 years) and primigravidity has been one of the main risk factors of developing birth asphyxia as mentioned in previous studies.¹⁶⁻¹⁸ Pre-term delivery also emerged as one of the significant risk factor of birth asphyxia as reported in past studies.¹⁷ It may be due to the fact that preterm babies face multiple morbidities including organ system, immaturity specially lung immaturation causing respiratory failure.¹⁶

Anaemia was widely prevalent in the mothers of neonates requiring resuscitation. The major maternal risk factors for newborns requiring resuscitation were PIH (46%), oligohydramnios (41%), polyhydramnios (30%) and decorum stained liquor (28%). The other risk factors include gestational diabetes mellitus (20%), PROM (18%), bleeding PV (17%), per partum pyrexia (16%), UTI (12%), and eclampsia (9%). 2 mothers were smokers and other 2 were tobacco chewers.

In order to reduce the burden of birth asphyxia, women need to educate with not respect to just about her pregnancy but also with respect to the complications which may arise during deliveries. In our study, meconium stained amniotic fluid was found to be present as one of the risk factor, findings were comparable with previous study also.¹⁹

Low birth weight was one of the major culprits for causing birth asphyxia.¹⁹ A potential confounder for this could be the fact that mother of low birth weight babies often related to complications such as maternal hypertension and

diabetes that present pre-conception or antepartum.²⁰ Hypertension can cause a decrement in blood flow resulting in asphyxia while anaemia causes intrapartum hypoxia.^{21,22}

Limitations

Small sample size of the study to extrapolate these results. Convenient sampling was employed. We mostly relied on the maternal history for evidence of anaemia, diabetes and hypertension.

CONCLUSION

In this study we found younger age of mother, hypertension, oligohydramnios, primigravidity, low socioeconomic status are important maternal risk factors for perinatal asphyxia. IUGR, prematurity, low birth weight, meconium-stained amniotic fluid and seizures were the factors associated with perinatal asphyxia.

The prevalence of perinatal asphyxia was high. Early detection and intervention of high risk mothers should be carried out to reduce the mortality.

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