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Research Article

A RETROSPECTIVE STUDY IN VISAKHAPATNAM ON DELAYED CRY AT BIRTH: AN IMPORTANT PREDICTOR OF FUTURE NEURO DEVELOPMENTAL PROBLEM-ASSOCIATED FACTORS

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ABSTRACT

Objectives: Cerebral palsy (CP) is a group of non-progressive neurological disorders caused by an injury to the area of the brain that controls muscle movement and posture. Physical and cognitive signs and symptoms that indicate CP vary widely, depending on which parts of the brain are affected, severity of the disease, and the age of the baby or child when symptoms first appear and one such symptom is delay in crying at birth.

Methods: Data collected from the mothers of 177 children of CP children with history of delayed cry at birth, admitted or attended to Rani Chandramani Devi Government Hospital, Visakhapatnam from the period of 2014–2020.

Results: The data collected retrospectively from the mothers of 177 CP children with history of delayed cry at birth were analyzed. Among them, 114 were male and 63 were female. Considering the age of the mother at the time of conception in the mothers of 177 CP children with delayed cry at birth, it was found that, more number of cases were reported in the maternal age between 19 and 30 years 106 (60%). The age of the mother at the time of conception, extremes of mother age both below 18 years and above 30 years, poses risk both to the mother and the fetus. In the present study, it was found to be 40%. Mothers with anemia were reported to be high 32.2% and act as a most prevalent antenatal factor of CP cases. By performing a student "t" test between the CP cases with associated factors and CP cases without associated factors, the results were highly significant $p<0.001$.

Conclusion: Delayed cry at birth should be taken as an early hint that the child might develop neurodevelopmental problems in the future. This should alert the parents and the family physicians and should be attended with appropriate consultation of a team of doctors to address any deviations observed at an early age for a better outcome.

Keywords: Cerebral palsy, Delayed cry, Maternal age, Abruption placenta, Prolonged labor, Meconium aspiration, Jaundice, Postnatal seizures.

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INTRODUCTION

During the whole pregnancy period, Oxygen and Nutrients are supplied to the baby from mother through the umbilical cord. Immediately after birth, once the umbilical cord is clamped, there will be lack of Oxygen for a transient period to the baby which acts as a stimulus for breathing attempt in the baby. Added to this, immediately after a baby is born, maneuvers for clearing the air passages such as mouth, nose, and throat area will also stimulate to make the baby cry. The first cry which draws the first breath of life will make the lungs open up. The initial cry attempts will expel the mucus and left over amniotic fluid from the air passages. If there is no cry immediately after birth and if the baby is healthy pink with arms and legs moving, then a painful stimulus like rubbing the body with a towel or stimulus in the nose with a suction canula can stimulate the breathing. By 1 min after delivery, most infants breathe well or cry. However, if the cry is further delayed with the color of the baby not healthy pink, bluish, or grayish with sluggish or no movements of the limbs, then it is an indication that, the baby is in trouble and not doing well.

Among the different factors associated, some antenatal, intranatal, and postnatal factors associated with the mothers of cerebral palsy (CP) children with delayed history of cry at birth were considered and data collected. Assessment of the spectrographic characteristics of crying can thus give investigators important information about function of those brain areas involved in brain disorders. Although advances in high-risk obstetric and neonatal care have resulted in improved survival of infants born preterm, many studies have documented the prevalence of a broad range of neurodevelopmental impairments in preterm survivors [1]. The spectrum of neurodevelopmental disabilities includes CP, mental retardation, visual and hearing impairments, and more subtle disorders of central nervous system function. These dysfunctions include language disorders, learning disabilities, attention deficit-hyperactivity disorder, minor neuromotor dysfunction or developmental coordination disorders, behavioral problems, and social-emotional difficulties. CP is caused by an injury to the immature brain that causes a disorder of movement and posture. It can occur before or during childbirth, or in their first 2 years of life. Children and adults with CP have problems of moving, controlling and coordinating their muscles. Some people with CP also have intellectual disabilities, seizures, and difficulties seeing or hearing [2]. The aim of the present study is to focus on the antenatal, intranatal, and postnatal factors associated with the CP children with a history of delayed cry after birth.

The aim of the present study was to focus on the antenatal, intranatal, and postnatal factors associated with the babies with delayed cry at birth.

METHODS

STUDY DESIGN

It is a retrospective study.

Study duration

The study was conducted in Rani Chandramani Devi Government Hospital, Visakhapatnam from the period of 2014 to 2020.

Inclusion criteria

The following criteria were included in the study:

1. Mothers of all ages included because emphasis was given on extreme ends of maternal age below 18 years and above 30 years
2. Regarding hypertension, mothers with gestational hypertension only are considered for statistical purpose
3. Regarding anemia, mothers who were advised and have taken treatment for anemia during pregnancy period were considered
4. History of premature rupture of membranes beyond 7th month and beyond 24 h are considered for study
5. Delivery of baby 18 h after the onset of pains in primi, 14 after the onset of pains multi para was considered for study as prolonged labor
6. Birth weight below 2500 g was taken as low birth weight
7. Delivery before 9th month of pregnancy was taken as preterm births as most of the mothers could give history in terms of months but not in weeks
8. Seizures occurring during the neonatal period (28 days after birth) were only considered for study.

Exclusion criteria

The following criteria were excluded from the study:

1. Abortions of the mother after the delivery of the present child under consideration were excluded from study
2. History of induced abortions were excluded from study
3. Mothers having history of hypertension prior to the pregnancy were excluded from study, that is, chronic hypertension
4. Babies named as "Low birth weight" by mothers delivered at home (not institutional deliveries) were excluded
5. Cases of physiological jaundice in new born were excluded
6. Seizures occurring in the new born beyond neonatal period are excluded.

Source of data

Data were collected from the mothers of 177 children of CP children with history of delayed cry at birth admitted or attended to hospital.

Among the antenatal factors the age of the mother at the time of conception, antenatal check-ups, anemia, hypertension, diabetes, hypothyroidism, prenatal birth, consanguinity, abortions prior to the CP child in consideration, and bleeding during pregnancy were considered. Among the intranatal factors, prolonged labor, pre-mature rupturing of membrane (PROM), and history of meconium aspiration were considered. Among postnatal factors, low birth weight, history of jaundice in new born, and convulsions after birth were considered. Data collected were analyzed and represented statistically in the form of percentages.

Statistical analysis

Data were analyzed using stata/SE version 16.0 and represented in terms of percentages and paired t' test analysis was used to determine the significance of associated factors and $p<0.05$ indicates significance.

RESULTS

The data collected retrospectively from the mothers of 177 CP children with history of delayed cry at birth were analyzed. Among them, 114 were male and 63 were female (Fig. 1). By examining the birth weight of the infant at birth, 48.5% babies were reported to have low birth weight and 51.5% have normal weight (Fig. 2). By studying the factor maternal factor, maternal age at the time of conception in the mothers of 177 CP children showing delayed cry during labor, it was found that, more number of cases were reported in the maternal age at the time of conception was in between 19 and 30 years 106 (60%) (Fig. 3 and Table 1). The age of the mother at the time of conception, extremes of mother age both below 18 years and above 30 years, poses risk both to the mother and the fetus. In the present study, it was found to be 40% (Table 1).

A number of antenatal factors were influencing CP in newborns. By considering these antenatal factors in the current investigation, from the Table 1, it was found that, among the mothers of 177 CP children, mothers with anemia were reported to be high 32.2% and act as a

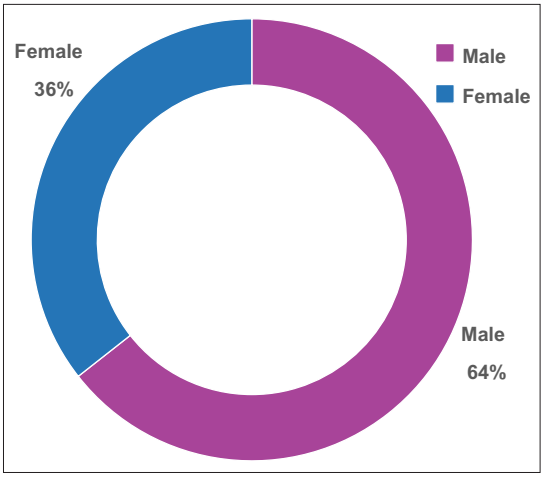

Fig. 1: Sex-wise distribution of cerebral palsy children with delayed cry

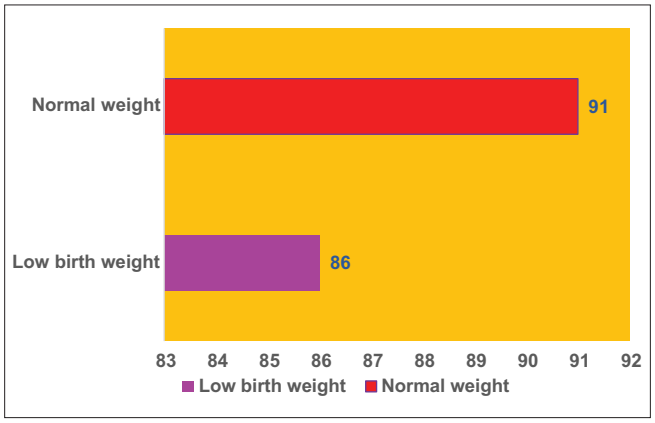

Fig. 2: Birth weight of the infant

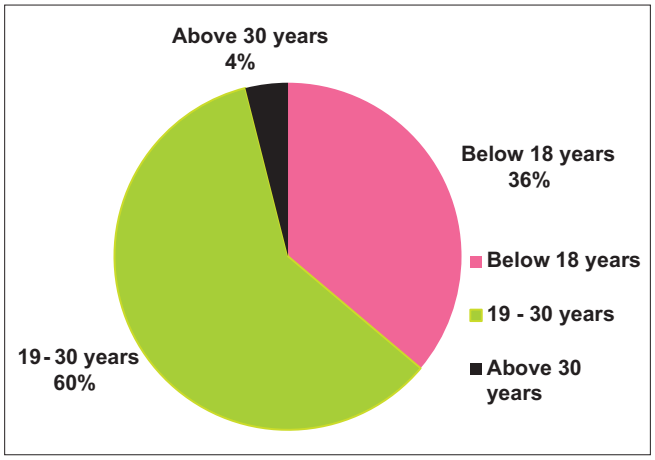

Fig. 3: Maternal age at the time of conception in cerebral palsy children

Table 1: Maternal age at the time of conception

Associated factor	Number of cases	Percentage
Maternal age at the time of conception (years)		
Below 18	64	36
19–30 year	106	60
Above 30 year	7	4

Table 2: Antenatal, intranatal, and postnatal factors associated with Cerebral Palsy

Associated factors	Number of CP cases with associated factors	(%)	Number of CP cases without associated factors	(%)
Antenatal factors (total number of CP children=177)				
Diabetes	6	3.38	171	96.61
Hypothyroidism	10	5.64	167	94.35
Abortion prior to the CP child	25	14.12	152	85.87
Anemia	57	32.20	120	67.79
Hypertension	7	3.95	170	96.04
Consanguinity	42	23.72	135	76.27
Preterm births	39	22.03	138	77.96
Intranatal factors				
Bleeding in pregnancy	9	5.08	168	94.91
Prolonged labor	34	19.20	143	80.79
PROM	8	4.51	169	95.48
Meconium aspiration	50	28.24	127	71.75
Postnatal factors				
Pathological jaundice	39	22.03	138	77.96
Postnatal seizures	72	40.67	105	59.32

Paired t-test analysis between CP cases with associated antenatal, intranatal, postnatal factors and CP cases without associated antenatal, intranatal, and postnatal factors. "t-test" statistics, t value−9.6055568233, P=0.0000005522 (highly significant), degrees of freedom−12

most prevalent antenatal factor of CP cases. By studying intranatal factors, meconium aspiration was noticed in 28.2% CP cases. On the other hand, among the most influencing postnatal factors, postnatal seizures were reported to be high 40.6% cases (Table 2). By performing a student "t" test between the CP cases with associated factors and CP cases without associated factors, the results were highly significant $p<0.001$.

DISCUSSION

Infant crying is a response to an internal or external stimulus. Infants cry as a form of basic instinctive communication. Essentially, newborns are transitioning from life in the womb to the external environment. Forcing air through the vocal tract and over the larynx produces cry. The process of controlling the air passing through the larynx is regulated, through the cranial nerves, by the brainstem and limbic system, functions of which are thought to be compromised in individuals with some brain disorders. CP is a musculoskeletal illness which causes movement problems due to injury to the developing brain. The damage to the brain is permanent, non-progressive, whereas the effects on musculoskeletal system are progressive. Among the antenatal factors, the age of the mother at the time of conception, antenatal check-ups, anemia, hypertension, and bleeding during pregnancy were considered. Among the intranatal factors, prolonged labor, PROM, and history of meconium aspiration were considered. Among postnatal factors, birth weight, history of jaundice in new born, and convulsions after birth were considered.

Among the maternal factors, considering the age of the mother at the time of conception, extremes of mother age both below 18 years and above 30 years, poses risk both to the mother and the fetus. In mothers below 18 years of age, the maternal problems could be anemia, cephalopelvic disproportion, and intrauterine growth retardation (IUGR). A research article conducted by Pintu [3] showed that women who got married at the age of ≤14 years are likely to have stillbirth, miscarriage or wasted pregnancy, and post-natal complications than the women who married at age of 18 years or above. In elderly primi, during pregnancy, there are, high chances of abortion, hypertension, bleeding during pregnancy due to placental abruption or placenta previa, gestational diabetes, and IUGR. At the time of delivery, elderly primi can have problems such as preterm labor, prolonged labor due to uterine inertia, increased operative deliveries, and postpartum hemorrhage [4]. Schneider *et al.* studied 1391 children with CP and found that 19% of children having mothers aged 35 years or older and 4% of children having mothers below the age of 20 years [5].

Regular antenatal check-up are very essential to identify any maternal or growing fetal problems. Maternal problems such as anemia, pregnancy-induced hypertension, hyperemesis gravidarum, thyroid problems, and bleeding problems during pregnancy need treatment under supervision of an expert, which if not attended can lead to grave danger to both the mother and the growing fetus. Fetal-related issues such as IUGR and twin pregnancy can be diagnosed at an early stage and appropriate care can be taken accordingly. All these problems can be tackled at an early age only if there is a regular antenatal check-up of the pregnant women.

Various studies have shown that anemia in pregnant women leads to IUGR and premature delivery. In our study, the authors found that, 57 cases have history of anemia. In a cross-sectional study conducted on 50 pregnant women over an year by Akhter *et al*. [6] concluded that, iron deficiency anemia in pregnancy had significant adverse effect on the fetal outcome. In a study by Wiegersma *et al*. [7] in contrast to maternal anemia diagnosed toward the end of pregnancy, anemia diagnosed earlier in pregnancy was associated with increased risk of the development of ASD, ADHD, and particularly ID in offspring.

Hypertension is considered to be present if the mother is having a blood pressure above 140 mm Hg systolic and 90 mm Hg diastolic blood pressure. Preeclampsia is gestational hypertension usually seen at or above 20 weeks of gestation. Hypertension has deleterious effects on the fetus in the form of reduction of nutrients and oxygen supply to the fetus through the placenta resulting in IUGR. Hypertension in pregnant woman can also result in preterm birth and abruption placenta both of which are risk factors for CP. In the study by Strand *et al*. [8], the authors concluded that exposure to preeclampsia was associated with CP. In an article published by Blair *et al*. [9], the authors interpreted that pregnancy-induced hypertension/pre-eclampsia does not protect against poor outcome at any gestational age. Previously reported protective effects originate from inappropriate control for gestational age and not from higher gestation-specific perinatal mortality.

Antepartum hemorrhage is bleeding through genitalia from 20th week of pregnancy to term. Abrupt placenta is the most common cause of Antepartum hemorrhage. Second most common cause is placenta previa. Bleeding in pregnancy will ultimately lead to reduced blood flow to the placenta and thereby to the umbilical cord which has direct effect on reducing the Oxygen and nutrients to the fetus. In our study, history of antepartum hemorrhage is noticed in 9 cases. In a study by Lam *et al*. [10], infants born to the mothers of bleeding group had low APGAR score at 1st min. In the research conducted by Philpot *et al*. [11], the authors opined that placental compromise through abruption and infarction plays important and dynamic roles in the development of CP.

Outcome of PROM depends on fetal age. Outcome of PROM also depend on the time lapse between PROM and onset of labor. More the time lapse, more the chances of poor outcome. High chances of infection affecting both mother and the fetus if the lapse between PROM and onset of labor are more. Premature ruptures of membranes of more than 24 h duration are associated with adverse neonatal outcome [12]. PROM before 37 weeks increases the risk of brain bleeds and brain injury, respiratory distress, muscle dysfunction, infection, and death [13]. In an article by Mynarek *et al*. [14], the authors conclude that intervals between PROM and delivery of more than 24 h were associated with CP, but not with neonatal mortality or death during delivery. The inverse association with stillbirth is probably due to reverse causality.

Among the intranatal factors prolonged labor and meconium aspiration are the important factors observed in the mothers of a child with delayed cry. Prolonged labor can be caused by cephalopelvic disproportion, uterine inertia, abnormal presentations, etc. Cephalopelvic disproportion can lead to increased incidence of the early rupture of the membranes; cord prolapse; and in neglected cases, obstructed labor. Increased operative interference, shock, postpartum hemorrhage, and sepsis. Trauma and asphyxia can occur to the fetus. Ultimately, it leads to increased perinatal mortality and morbidity [15].

In a study by Philpot *et al*. [11], the authors while discussing the risk factors that specifically occur during intrapartum period mentioned that complications surrounding labor associated with CP include uterine rupture, cord around the neck, prolonged labor, abnormal fetal presentation, multiple gestation, and chorioamnionitis.

Meconium is the first stool of the baby. Meconium is usually expelled after birth. Certain fetal stress conditions can lead to expulsion of meconium before birth into the amniotic fluid. Meconium stained amniotic fluid if inhaled by the baby can lead to chemical pneumonitis, surfactant dysfunction, and pulmonary hypertension. This can lead to death of the new born or long-term neurological sequelae in survived babies [16]. In the article by Philpot *et al*. [11], the authors mentioned that, during intrapartum period, markers of fetal stress-abnormal fetal heart rate tracing and meconium-stained amniotic fluid and subsequent low Apgar scores have been associated with CP [11].

Among the postnatal factors, jaundice and epilepsyin the new born are observed in the mothers of a child with delayed cry. Physiological jaundice normally seen from 2 to 3 days after birth. It normally disappears by 8th to 10th day. Various criteria have been formulated for defining Pathological jaundice. Jaundice appearing before 24 h of birth, Jaundice persisting more than 1 week in term infant, more than 2 weeks in preterm infant, and those requiring phototherapy [15] can be considered as far as history from the mothers is taken into consideration. In our study, history of jaundice is present in 39 children out of 177 children with absent cry after delivery. Bilirubin deposition in brain can take place in basal ganglia, cranial nerve nuclei, hippocampus, anterior horn cells of spinal cord, and brain stem nuclei. Bilirubin is neurotoxic and leads to neuronal degeneration. Rose and Vassar [17] in their study concluded that, the link between exposure to elevated, neurotoxic TB levels, and severe neonatal motor symptoms and dyskinetic CP is well established. However, the influence of exposure to low-moderate levels of TB on the developing CNS is not well understood.

In a new born, seizures can be due to iatrogenic, traumatic, metabolic, and congenital. Infections in mothers in pregnancy period can lead to increased risk of epilepsy and CP in children. Postnatal seizures can occur due to fever, perinatal asphyxia, and hypoglycemia. In our study, there is a history of seizures after birth in 72 cases out of 172. In a cohort study by Nunes *et al*. [18], the study showed that neonatal seizures predominated in term newborns with perinatal asphyxia an elevated perinatal mortality and postnatal neonatal morbidity. Their follow-up study showed an increased risk of developing postnatal epilepsy and developmental delay in future. In an article by Legido *et al*. [19], the authors studied forty infants with electroencephalographic (EEG) documented seizures of diverse etiologies. Infants whose neonatal seizures were confirmed by randomly recorded ictal EEG tracings were examined retrospectively to evaluate their global neurologic outcome and the specific frequency of epilepsy, development delay, and CP. They have also examined perinatal and postnatal clinical and EEG variables for their relevance to the neurologic outcome. The 27 survivors were followed up at a mean of 31 months. The results were that, the outcome was unfavorable in 70%. The rate of epilepsy was 56%, of developmental delay 67%, and of CP 63%. They opined that, the etiology of seizures was an important factor influencing the outcome [19].

CONCLUSION

All the factors discussed above either in single or in various combinations could cause problems of brain damage either antenatal or intranatal or postnatally which may reflect in the form of delayed cry after birth with resulting neurodevelopmental problems observed in the growing child. Delayed cry at birth should be taken as an early hint that the child may develop neurodevelopmental problems in future. This should alert the parents and the family physicians to have a close watch on the child developmental mile stones and deviations from normal should be attended with appropriate consultation of a pediatrician, neurophysician, orthopedician, physiotherapist, clinical psychologist, or a speech therapist so as to attend any deviations observed at an early age for a better outcome.

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AUTHORS' CONTRIBUTIONS

Author T. Srinivasa Rao contributed conceptual design, performed the work, and wrote the first draft of manuscript. Author S. Narasinga Rao corrected the manuscript and author T.D.P Subbalakshmi collected the literature and data.

CONFLICTS OF INTEREST

The authors declared no conflicts of interest.

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