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Cerebral Palsy in Children - an indicator of maternal care in pregnancy - How far are we from attaining continuum of care

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ABSTRACT

Background: Cerebral palsy (CP) is an umbrella term covering a group of disorders arising from a non-progressive injury to the brain during its development. It results from injury to developing brains. These injuries can be both intrauterine or peripartum. Better antenatal and peripartum care will help in decreasing the number of children with CP. **Aims and Objectives:** The objective of the study was to evaluate antenatal as well as post-natal risk factors of CP in children in Uttar Pradesh. **Materials and Methods:** Observational cross-sectional study was conducted on children aged 2–14 years with CP visiting Pediatric Neurology clinic of Dr. Ram Manohar Lohia Institute of Medical Sciences. **Results:** 104 children were enrolled in the study. Mean age of children enrolled for the study was 2.8 years. About 66% were vaginally delivered. About 83% (n = 86) were term deliveries. Intrapartum complication was seen in 33% (n = 34) of mothers. Most common peripartum complication was prolonged labor (100%, n = 34) followed by meconium stained liquor (85%, n = 29). Cord around neck was seen in 24% (n = 8) of cases. About 25% of were low birth weight. About 49.4% (n = 42) were attended by Angan Wadi workers. Most common motor type of CP was spastic quadriplegia (57.6%, n = 60), followed by spastic diplegia (23%, n = 24), spastic hemiplegia (10.57%, n = 11), and hypotonic CP (7.6%, n = 8). **Conclusion:** Majority of study were delivered vaginally and at term yet 82% had perinatal asphyxia and nearly 50% were received by Anganwadi workers. Better antenatal and perinatal care are the road to prevention of CP.

Key words: Cerebral palsy; Complication; Labor; National programme; Rehabilitation

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INTRODUCTION

Cerebral palsy (CP) a disorder of movement and posture was first described way back in 1840 by William Little. CP is a blanket terminology which encompasses a group of non-progressive motor impairment syndromes secondary to lesions or anomalies of the brain arising in the early stages of its development.[1] It is the leading cause of chronic disability in children.[2] There is no single cause of CP. It results from complications both intrauterine and postpartum resulting in injury to developing brains of the child. It has been seen that more than 94% of CP cases had their brain injury during the antenatal or the neonatal period.[1]

Hence, it can be accepted that better antenatal and post-natal care will not only improve the neonatal and maternal mortality rate but can decrease the incidence of CP. While majority of health-care focus is to reduce neonatal death rates we forget that morbidity too has significant health consequences. CP continues to remain the leading cause of disability in children and adults. This has both financial and social implications on any society. Countries like India need to recognize preventive measures of CP. The incidence of CP worldwide is 2–2.5 cases per 1000 live births and in India it is estimated at around three cases per 1000 live births figures. These are approximate values the actual value would be way higher than this.[2]

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Uttar Pradesh is the most populous state of India. As per the latest NFHS 4 data the percentage of institutional delivery has increased significantly from 20.6 in 2006 to 67.8 in 2016 but it is way less than national average of 78.9%[3] The percentage of home deliveries is still very high in Uttar Pradesh. Only 0.8% children who are born at home are taken to a health facility for check-up within 24 h of birth.[4] Mothers who had received full antenatal care in Uttar Pradesh is 5.9% compared to national average of 21%.[3] Although the state has shown marked improvement compared to what it was 10 years ago, we still have a long way to go in improving the maternal healthcare which indirectly affects child's growth and development.

Aims and objectives

We conducted the present study with the objectives of evaluating antenatal as well as post natal risk factors of CP in children in Uttar Pradesh. In addition we studied the health parameters of children with CP.

MATERIALS AND METHODS

Design setting and participants

An observational cross-sectional study was conducted in Pediatric Neurology clinic of Dr. Ram Manohar Lohia Institute of Medical Sciences. Children aged between 2 and 14 years with CP visiting pediatric neurology OPD between March 2019 and March 2020 were included in the study. The study was pre-approved by the Institutional Ethics Committee for the final permission. Children with congenital anomalies, progressive neurological disease, musculoskeletal cause of weakness, dystonia (congenital dislocation of HIP, and myopathy), hypothyroidism or concurrent chronic systemic illness (cardiac, renal, etc.) were excluded from the study. Children whose parents refused to give consent for the study were also excluded from the study.

CP is classified based on the type of neuromuscular deficit into (i) spastic, (ii) dyskinetic (inclusive of choreoathetoid and dystonic), (iii) ataxic, (iv) hypotonic, and (v) mixed.[3]

Definitions used in the study

- CP is a group of non-progressive motor impairment syndromes secondary to lesions or anomalies of the brain arising in the early stages of its development[1]
- Hypotonia is defined as low muscle tone, causing a loss of strength and firmness
- Hypertonia is defined as high muscle tone, causing rigidity and spasmodic movement
- Hemiplegic CP is defined as unilateral paresis with the upper limbs more severely affected than the lower limbs[3]
- Spastic CP: In spastic CP there are upper motor neuron signs, weakness, hypertonia, hyperreflexia, clonus, and positive Babinski[3]
- Spastic diplegia is defined as spasticity more in the lower limbs compared to upper limbs[5]
- Spastic Quadriplegia is defined as spasticity in all four limbs[3]
- Dyskinesia is manifested by extra pyramidal involvement in which rigidity, chorea, choreoathetosis, athetoid, and dystonic movements are seen[3]
- Hypotonic CP is manifested by generalized muscular hypotonia without resulting from a primary disorder of muscle or peripheral nerve[3]
- Seizures defined as sudden paroxysmal transitory disturbance in brain function which starts suddenly, stops spontaneously and shows a tendency to recur. Manifestations can include motor, sensory, psychic, (or) autonomic disturbances with, (or) without alteration in sensorium[5]
- Antenatal care: Antenatal care is the systemic supervision of women during pregnancy to monitor the progress of fetal growth and to ascertain the well-being of the mother and the fetus. Every pregnant woman makes at least four visits for ANC, including the first visit/registration along with mothers receiving iron and folic acid for at least 100 days during pregnancy[6]
- Inadequate spacing: The World Health Organization (WHO) recommends 24 months between two pregnancies. A shorter interval will be called inadequate spacing between the pregnancies
- Severe acute malnutrition (SAM): SAM is defined by a very low weight for height (below -3z scores of the median WHO growth standards), by visible severe wasting, or by the presence of nutritional edema.

Study protocol

Informed consent was taken from parent/guardian of the child who was enrolled in the study. Detailed history was taken on the developmental milestones of the child and its siblings, type of delivery, place of delivery, the antenatal and post natal care received by the mother, level of neonatal care received by the child with detailed records of use of ventilators, blood transfusion, history of phototherapy or exchange transfusion and neonatal seizure. History of seizures including need for antiepileptic therapy, impairments in vision and/or hearing was also enquired. Thorough examination of the patient was undertaken and recorded

in a predesigned pro forma. Neurological examination was performed by the neurologist who assessed the type and extent of motor disabilities. All participants were classified into following types (i) spastic, (ii) dyskinetic (inclusive of choreoathetoid and dystonic), (iii) ataxic, (iv) hypotonic, and (v) mixed based on the type of neuromuscular deficit.[3] Gross Motor Function Classification System was used to assess the muscle power. In this classification the functional characteristics are divided into five levels, from I to V. Class I denotes best and Class V denotes worst functional capability. Ophthalmological examination and a screening test for hearing assessment using brain stem evoked response audiometry (BERA) was performed in all participants. Neuroimaging (computed tomography scan/magnetic resonance imaging) was performed in all patients based on the feasibility as per the American Academy of Neurology guidelines.

RESULTS

104 children fitted into the inclusion criteria and were enrolled in this study. Of these 94% (n=98) children were not delivered in our institute (outborn delivery). Mean age of children enrolled for the study was 2.8 years. More than 90% of children were below 5 years of age. Majority were males 69% (n=72) and belonged to rural areas (95%, n=71). Children included in our study belonged to Lucknow and its adjoining districts as shown.

About 95% (n=99) of the study population were institutional deliveries. Of these institutional deliveries 63% (n=59) were delivered in government institutions remaining in private healthcare facilities. More than two thirds (66%, n=69) were delivered vaginally and their mothers had no antepartum complications. Of the babies delivered by Caesarean Section 66% (n=23) were delivered by emergency caesarean section. Majority of study population was delivered at term (83%, n=86) with only 11% (n=12) delivered prematurely as shown in Figure 1.

Intrapartum complication was seen in 33% (n=34) of mothers. Most common peripartum complication was prolonged labor (n=34) followed by meconium stained liquor (n=29). Cord around neck was seen in 24% (n=8) of cases. Nearly 25% of study population were low birth weight as shown in Figure 2.

Mean birth weight was 2.65 kg. 82% (n=85) of study population had history of perinatal asphyxia. Less than 50% (n=39) of them were resuscitated by pediatricians. Nearly half of them (49.4%, n=42) were attended by Anganwadi workers. There were four cases that were delivered during transport and received no resuscitation. About 10% (n=10) of mothers had history of complications in past pregnancy as well. Average no of children per family in our study population was 2.73% (n=76) of children had normal healthy siblings with no history of developmental delay in them. Only four cases (3.8%) had history of developmental delay in their siblings. In nearly two third cases (63% n=66), there was inadequate spacing between the pregnancies. More than half of the study population (58.6%, n=61) were admitted in neonatal intensive care unit after birth with mean duration being 12.6 days. The neonatal complications developed are shown in Figure 3. About 12.5% (n=13) of children had a post-natal cause of developmental delay.

On examination of these children the most common motor type of CP was spastic quadriplegia (57.6%, n=60), followed by spastic diplegia (23%, n=24), spastic hemiplegia (10.57%, n=11), and hypotonic CP (7.6%, n=8). Only 1 child had athetoid type CP. We found that majority of children (60.5%, n=63) were undernourished. Nearly 34% (n=35) of study children had SAM. Pallor was seen in 87.5% (n=91) children with

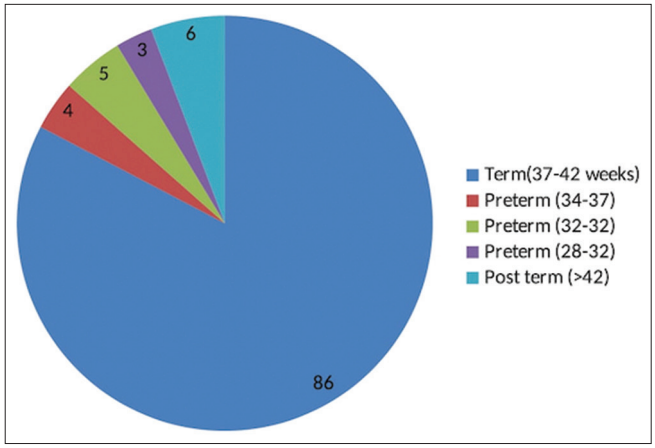

Figure 1: Gestational age of babies

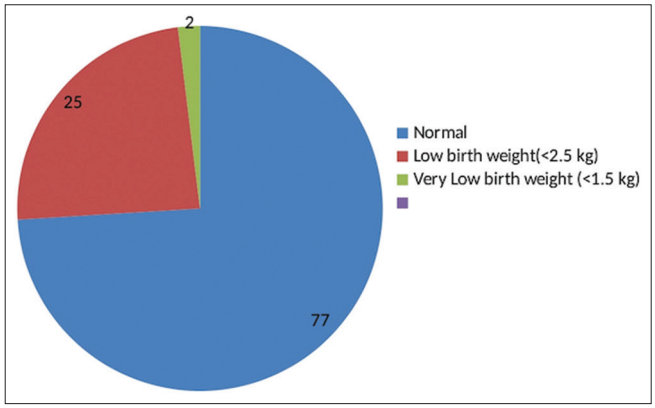

Figure 2: Birth weight of babies

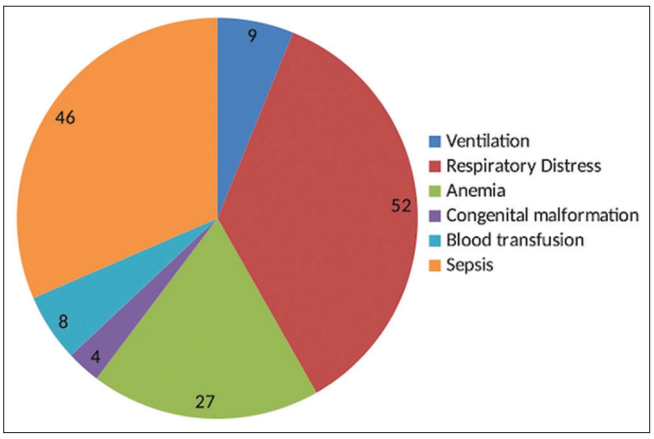

Figure 3: Neonatal intensive care unit complications

mean hemoglobin level being 9.9 g/dl. 35.5% (n=37) of study participants had vitamin D deficiency. About 39.4% (n=41) of children had feeding problems. About 15.3% (n=16) of study population had hearing defects as detected by BERA and 24 % (n=25) had vision defects. Visual impairments seen in the study population were fixation defects, squint, and refractive errors. About 50% (n=52) of children had behavioral problems. The most common behavioral problem was aggression and irritability. None of them had received any counseling sessions.3 children were diagnosed with autism. Nearly 27% (n=28) of study population were hospitalized more than once. Most common cause of hospitalization was seizures followed by aspiration and sepsis. About 42.3% (n=44) were diagnosed with seizure disorder and had abnormal EEG findings. Neuroimaging was done in all participants. It was found normal in 17% (n=18) of children. The most common MRI findings were of cerebral atrophy followed by cystic encephalomalacia.

DISCUSSION

Over the last decade, there has been significant focus on understanding the etiology of CP.[7] Multiple preventable interacting risk factors peripartum and postpartum are responsible for significant proportion of CP.[8-10] Despite our understanding of the probable risk factors there has not been a significant decline in the cases of CP. Studies in the past have shown low birthweight, meconium aspiration, instrumental/emergency Caesarean delivery, birth asphyxia, neonatal seizures, respiratory distress syndrome, hypoglycemia, and neonatal infection as the most probable risk factors of CP.[11-17] Majority of these risk factors are preventable. Government of India (GOI) has launched several capacity building programs like Dakshata for improving the quality of care during intrapartum and immediate postpartum period across delivery points in the country, Janani Suraksha Yojana to improve the institutional delivery rate and Pradhan Mantri Surakshit Matritva Abhiyan which will provide fixed-day antenatal care to all pregnant women (in 2nd and 3rd trimester) on the 9th of every month.[18] The aim of all these programs is to provide quality services to pregnant women and their newborns to reduce their mortality and morbidity. The results are also seen with significant improvement in neonatal and maternal mortality but when it comes to number of children with CP there has not been a significant change. The consistent efforts of GOI have shown results in our study too. We found 95% of mothers had institutional deliveries with a significant percentage delivered in government institutions. Again a large population (66%) was delivered vaginally and majority were delivered at term (83%). Nearly half the deliveries were received by Anganwadi workers. It is a well-known fact that initial management of perinatal asphyxia will decide the motor, cognitive, and sensory developmental disabilities in later years.[19] Thus this study shows that these Anganwadi workers need further training in neonatal resuscitation. As when inquired from the mothers nearly all the babies who had did not cry after birth where not resuscitated as per the protocols and many where referred late to hospitals. Similar finding was also seen in another study in India[20] Poor intrapartum care due to unskilled birth attendance has emerged as one of the main risk factor of CP. Despite a good percentage of babies being delivered at term (83%) and having normal birth weight (74%) these babies developed CP only goes on to explain that though we have provided them care the quality of care was less than optimum. Hence, besides providing care, we have to ensure that the birth attendants are trained as per protocol. Intrapartum complication was seen in nearly one third of mothers. Most common was prolonged labor followed by meconium stained liquor. Both these complications are known risk factors of CP[21] This further emphasizes the need further training of Anganwadi workers to address these known and preventable intrapartum complications. Similar findings were seen in a rehabilitation center in another study from Uttar Pradesh.[22] Nearly half of our study population had history of admission in NICU with respiratory distress and neonatal sepsis being the most common complication and the most common risk factor for developing CP. This finding is similar to previous studies.[20-23]

On examination the most common type was spastic quadriplegia followed by spastic diplegia. This pattern of presentation is similar to another study from Northern India.[24] SAM, anemia and nutritional rickets were the major comorbidities. This could be explained by the feeding problems and lack of nutritional guidance in these children. Maintenance of normal nutrition is difficult in these children and there have been

studies showing high prevalence of malnutrition in these children.[22,24,25] Vicious cycle of malnutrition and infection is known. This could explain the high incidence of repeated hospitalization seen in nearly one third of study population due to sepsis.

Limitations of the study

This is a single centre experience with small sample size. Similar studies need to be conducted from different parts of the country and with larger sample size

CONCLUSION

CP is a preventable neuromotor disability. Improvisation of antenatal and postnatal services with better training of care givers is the need of the hour. We need to emphasize the importance of implementation of national programs related to mother and child in the community. Community participation and their awareness is the success to any national programs.

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NT and NR- Planned the study. **NT, NR, and VS-** Reviewed the literature. **NT, NR, and DS-** Formulated and analysed the data. **NT, NR, VS, and DS-** Prepared the final manuscript.

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