RESEARCH ARTICLE

ASSOCIATION OF MOTHER'S AGE AT CONCEPTION, BIRTH ENVIRONMENT, GESTATIONAL AGE WITH THE TYPE OF CEREBRAL PALSY

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ABSTRACT

Background: The contribution of adverse consequences of preterm birth to gestational age related risk of cerebral palsy (CP) has rarely been studied. ***Objectives:*** To determine the relationship of Mother's Age at conception, Birth Environment and Gestational age at birth with the Type and distribution of Cerebral Palsy. ***Methods:*** Study design: Correlation Study, Total number 50 CP children were selected for study, diagnosed by pediatrician. The reported data was converted to the terminology suggested by the SCPE 2000 for convenience. CP children were divided into a preterm and term group, spastic (unilateral, bilateral) and non spastic group (athetoid, ataxic). The age of mother at the time of conception in years was categorizedas in travels of five year between 16-40 year age groups. Birth environments divided in to Supervised and unsupervised delivery. ***Result:*** The demographic profile of 50 respondents(mother's age at conception) showed that 10 (20 %), 20 (40.0%), 13 (26 %), 5(10%), 2 (4 %) were in the age group of 16-20 yesrs 21-25 years, 26–30 years, 31–35 years, and 36-40 years respectively. ***Conclusion:*** In preterm infants spastic CP is predominant. In term infants the non- spastic form of CP is more prevalent than in preterm infants. And doctor reduces therisk of prevalence of cerebral palsy in most common type of CP in diplegic group.

INTRODUCTION

Cerebral palsy (CP) is one of well-recognized neurodevelopmental conditions, beginning in early childhood and persisting through the lifespan.[1] Abnormal motor behaviour is the core feature of CP.[2] The etiology is mostly unknown and the prevalence is between 1.0 and 2.4 per 1000 live births. The prevalence has not decreased in comparison to the past decades, although many advances have occurred in obstetric and neonatal care. In fact, it seems that the prevalence might have even increased in term infants. The increasing prevalence of neuro-developmental disorders in the extremely low birth weight (ELBW) infants, i.e. those with a birth weight of <1000 g, and the extremely immature infants, i.e. those with a gestational age of <26 weeks, has constantly raised concerns. Although mortality has decreased in these groups of infants, the neurological disability rate has not changed or has only slightly decreased.[3]

Although complications of labour and delivery were previously viewed as the main causal factors, more recent evidence has implicated prenatal factors in the pathogenesis of cerebral palsy. The latter include congenital malformations, vascular insults (e.g., those causing prenatal stroke) and maternal infection.

This emphasis on intrauterine factors led us to question the conventional epidemiologic formulation expressing the gestational age relationship of cerebral palsy. A predominantly prenatal etiology implies that fetuses, rather than live births, are the appropriate candidates at risk for developing cerebral palsy.[4] The prevalence of CP significantly decreases with increasing GA (gestational age) category 14.6% at 22 to 27 weeks' gestation, 6.2% at 28 to 31 weeks, 0.7% at 32 to 36 weeks, and 0.1% in term infants. A significant decrease in prevalence of CP starts at 27 weeks. In terms of the type of CP we found that the spastic type of CP was the predominant form in preterm and term infants. The non-spastic varieties such as dyskinesia or ataxia were much more frequent in term than in preterm infants.[5] There are various researches in the past which have seen the effect of mother age at conception or gestational age at birth or birth environment on the prevalence of cerebral palsy. But, there is no study done in Indian cities which shows the relation of mother age at conception, gestational age with the type of cerebral palsy. Hence, this study was conducted to checkout that whether there is any association between mother age at conception, birth environment and gestational age with type of cerebral palsy.

MATERIAL AND METHODS

The present cross-sectional analytical study was carried out in Dehradun city of Uttarakhand state, during 15 May 2011 to 15 July 2011. The subjects to be studied were selected from National institute of orthopaedic handicapped (NIOH) & National institute of visual handicapped (NIVH), Ahsas foundation, Maharaja Agrasen hospital, Jankalyan hospital, Dolphin health center, Tushar project, Ashimit, Doon early intervention centre (DEIC) Doon hospital all these were present in Dehradun city. Total 50 CP children meeting participant the inclusion criteria were selected for study Subjects were cerebral palsy children residing in Dehradun city.

Inclusion criteria

- Informant (Mother/ Caregiver) of child with Cerebral palsy.
- Presence of previous medical records of pregnancy & child birth.

Exclusion criteria

- Parents/caregivers of children with neurological conditions other than cerebral palsy.
- CP children with no previous medical records available.
- Type of CP diagnosed by paediatrician.

Procedure; Selection of various cerebral palsy rehabilitation centers, paediatric clinics, NGO's and community from Dehradun was done through convinient random sampling. Out of 76 subjects studied, 20 had undiagnosed subtype of Cerebral palsy and 6 subjects were from other districts. So, they were excluded from the study. Ethical clearance for conducting the study was taken from the ethical committee of the institution, NGOs, Rehabilitation centre, Government hospital of Dehradun, with the assurance that confidentiality would be maintained and the information obtained for this study, would not be used for any other purpose except for research. The total number of sample respondents came to 50. The caregivers/mother's were informed about the purpose of the study and they were assured about confidentiality and written consent was obtained. A pre-assessment form was used to collect individual data and the questions asked were in the local vernacular language and about their socio-demographic data, delivery practices and the associated factors. Information regarding the mother age at conception, birth environment, gestational age at birth of child and the type of cerebral palsy were collected from the mother/ caregivers and previous medical records. Terminology for distribution of type of cerebral palsy varied within different clinical set ups. So, the reported data was converted to the terminology suggested by the SCPE 2000 for convenience of the study. Later data analysis was done to find out any association between these confounding factors. Statistics were performed by using SPSS 13 (Statistics package for the Social Sciences). Results were calculated by using 0.05 level of significance. Using statistical formula for the mean, for a given number of subjects, mean of different variables were calculated by -:
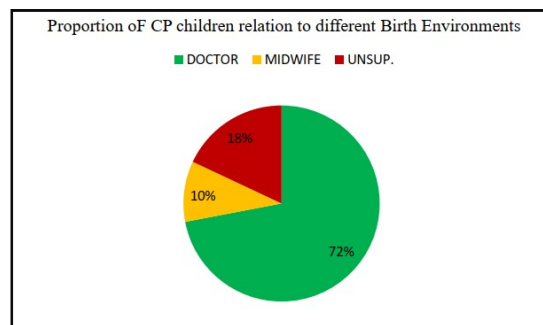
$$\overline{X} = \frac{\sum X}{N}$$

Where, N = Number of subjects
X = each subjects value

RESULT AND OBESEVATIONS

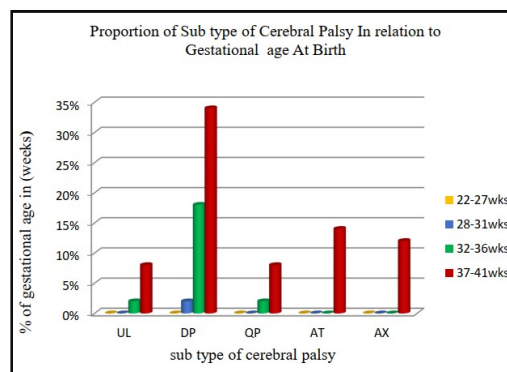### Table 1 Proportion of male and female Cerebral Palsy children

GENDER	NUMBER (% OF SUBJECTS)
Males	33(66%)
Females	17(34%)

Fig 1: Depicts proportion of Spastic Vs Non spastic Cerebral Palsy

Table 2. Proportion of Cerebral Palsy occurrence with Mother's Age at Conception

Mother's age (Years)	Number (% of CP.)
16-20 years	10 (20%)
21-25 years	20 (40%)
26-30 years	13 (26%)
31-35 years	05 (10%)
36-40 years	02 (4%)

Fig 2. Depicts the proportion of sub type of cerebral palsy in relation to mother's age at conception

Table 3. Correlation of Mother's Age at Conception and Type of Cerebral Palsy

Mother's Age	Spastic group		Non Spastic group	
	r value	P value	r value	P value
16 – 20 years	0.182	P > 0.05	-0.182	P > 0.05
21 – 25 years	0.019	P > 0.05	-0.019	P > 0.05
26 – 30 years	-0.272	P > 0.05	0.272	P > 0.05
31 – 35 years	0.198	P > 0.05	-0.198	P > 0.05
36 – 40 years	-0.112	P > 0.05	0.112	P > 0.05

DISCUSSION

In the present study we had consider 3 parameters mother age at conception, birth environment, gestational age at birth and its association with the type of CP. We got variation in the result. That mother age at conception in different age groups (16-20, 21-25, 26-30, 31- 35, 36-40 in years) had correlation with the type of CP i.e. (spastic and non spastic) but this correlation was not statically significant. In our study since the correlation was not statically significant the reason can be one that the sample size was small, second the subjects which were included in the study i.e. 21-25 years of age group and 26-30 years had 20 and 13 CP children respectively, while the age group 16-20 had only 10, 31-35 had 5 and 36 – 40 had only 2 CP child seen. This age group i.e. (21-30 years) comes closed to the age group which is appropriate for a women to become pregnant while it has been proved previously that if the mother is less than 20 years or more than 35 years then the risk factor for CP increase.[25]

Table 4: Correlation of Mother's age and Subtype of Cerebral Palsy

Correlation Mother's Age	Unilateral		Diplegic		quadriplegic		athetoid		ataxic	
	r value	P value	r value	P value	r value	P value	r value	P value	r value	P value
16 – 20 years	-.167	P > 0.05	.223	P > 0.05	.084	P > 0.05	-.202	P > 0.05	-.031	P > 0.05
21 – 25 years	.136	P > 0.05	.033	P > 0.05	-.206	P > 0.05	.024	P > 0.05	-.050	P > 0.05
26 – 30 years	-.198	P > 0.05	-.142	P > 0.05	.042	P > 0.05	.286	P < 0.05	.062	P > 0.05
31 – 35 years	-.111	P > 0.05	.149	P > 0.05	.197	P > 0.05	-.134	P > 0.05	-.123	P > 0.05
36 – 40 years	.272	P > 0.05	-.240	P > 0.05	-.052	P > 0.05	-.082	P > 0.05	.239	P > 0.05

Table 5. Proportion of type of cerebral palsy according to birth environment

BIRTH ENVIRONMENT	SPASTIC GROUP			NON SPASTIC GROUP		TOTAL (%)
	UL	DP	QP	AT	AX	
DOCTOR	5(10%)	17(34%)	3(6%)	6(12%)	5(10%)	36(72%)
MIDWIFE	0(0%)	5(10%)	0(0%)	0(0%)	0(0%)	5(10%)
UN SUP.	0(0%)	7(14%)	0(0%)	1(2%)	1(2%)	9(18%)
TOTAL (%)	5(10%)	29(58%)	3(6%)	7(14%)	6(12%)	50(100%)

Table 6. Correlation of Birth Environment at Birth and Type of Cerebral Palsy

Birth Environment	Spasticity		Non Spasticity	
	r value	P value	r value	P value
Doctors	-0.167	P > 0.05	0.167	P > 0.05
Mid-Wife	0.198	P > 0.05	-0.198	P > 0.05
Unsupervised	0.040	P > 0.05	-0.040	P > 0.05

Table 7. Correlation of sub type of Cerebral Palsy according to Birth environments

Correlation Birth Environment	Unilateral		Diplegic		quadriplegic		Athetoid		ataxic	
	r value	P value	r value	P value	r value	P value	r value	P value	r value	P value
Doctors	.208	P > 0.05	-.350	**P < 0.05**	.158	P > 0.05	.123	P > 0.05	.093	P > 0.05
Mid-Wife	-.111	P > 0.05	.284	**P < 0.05**	-.084	P > 0.05	-.134	P > 0.05	-.123	P > 0.05
Unsupervised	-.156	P > 0.05	.188	P > 0.05	-.118	P > 0.05	-.039	P > 0.05	-.013	P > 0.05

So, since the group distribution was uneven among the all five age groups, the results changed. This uneven distribution was due to the reason that population was taken from Dehradun city area only. Hence, the people were more aware. Thus, the number of female less than 20 years and more than 35 years. Who had children were difficult to find out. Secondly, it was seen that there was negative correlation between doctor and spastic group but it is not statically significant. The correlation between doctor and non spastic group was again not statically significant. The reason for both is that may be the small sample size. But, if we see table 7 there was seen a negative correlation between doctor and diplegic group of CP and it was statically significant. While there was no correlation between the midwives and unsupervised with the sub type of CP. This may related to the fact that doctors/gynaecologist are well qualified and have lot of practice in the field of delivery more over there are all facilities available in the hospital set ups like ventilator facilities, PICIUs, good nursing facilities etc. Which all reduce the risk of asphyxia or any other complication during delivery. Whereas correlation with midwives was also seen positively significant which can be due to small sample size i.e. only 5 CP children and secondly midwives could have been untrained and inexperienced, the knowledge of which could not be obtained from the informants. Moreover, all the facilities doctor gets during the procedure of delivery.

The midwives can't gait in home environments. Maximum risk factor is with the untrained people who practice deliveries but in this study there was no significant correlation, which definitely is due to small sample size. Thirdly, a significant correlation was found between the GA and type and distribution of cerebral palsy. In preterm infants (22-36 weeks) a significant correlation was found between gestational age at birth with the spastic type of CP and a significant negative correlation was found with the non spastic type of CP. The reason could be due to the existence of periventricular leukomalacia is the strongest and most independent risk factor for the subsequent development of CP in preterm infants.

The grade of PVL(periventricular leukomalacia) is significantly correlated with the clinical type and severity of cerebral palsy . Most Preterm infants with major intracranial hemorrhage develop spastic diplegia, triplegia or hemiplegia. The pathogenesis of periventricular leukomalacia relates to three major factors. The first two of these, an incomplete state of development of the vascular supply to the cerebral white matter and a maturation-dependent impairment in regulation of cerebral blood flow, underlie a propensity for ischemic injury to cerebral white matter. The third major pathogenic factor is the maturation-dependent vulnerability of the oligodendroglial precursor cell that represents the major cellular target in PVL. The germinal zones are most active between approximately 8 and 28 weeks of gestation. Intrauterine exposure to infection and fetal inflammation are also related to an increased risk for PVL and CP . The most common site of intraventricular hemorrhage in the preterm infant is the subependymal germinal matrix region. The germinal matrix area is highly vascularized. The integrity of the capillaries in the germinal matrix is tenuous because of the lack of supportive tissue. Germinal matrix hemorrhage may be unilateral or bilateral and occurs in isolation in most preterm infants. In term infants a a significant correlation was found between gestational age at birth 37-41 weeks with the non spastic type of CP and a significant negative correlation was found with the spastic type of CP. Reason may be due to the Term infants subjected to prolonged partial asphyxial episodes most often have lesions of the cerebral cortex in a watershed type of distribution. They have pyramidal-spastic signs of cerebral palsy. In term infants the most common injuries are parasagittal cerebral injury, injuries to basal ganglia and focal ischemia. In term infants the vascular boundary zones lie in the regions between the anterior and middle cerebral arteries and between the middle and the posterior cerebral arteries.

Table 8. Proportion of gestational age at birth with the % of Cerebral Palsy children

GESTATIONAL AGE IN (WEEKS)	NUMBER (% OF CP.)
22-27 weeks	0 (0%)
28-31 weeks	01 (2%)
32-36 weeks	11 (22%)
37-41 weeks	38 (76%)

Table 11. Correlation of Gestational Age at Birth and Subtype of cp

Correlation Gestational Age at Birth	Unilateral		Diplegic		qudriplegic		athetoid		ataxic	
	r value	P value	r value	P value	r value	P value	r value	P value	r value	P value
22 – 27 weeks	A	P > 0.05	a	P > 0.05	a	P > 0.05	a	P > 0.05	a	P > 0.05
28 – 31 weeks	-.048	P > 0.05	.122	P > 0.05	-.036	P > 0.05	-.058	P > 0.05	-.053	P > 0.05
32 – 36 weeks	-.016	P > 0.05	.256	P > 0.05	.069	P > 0.05	-.214	P > 0.05	-.196	P > 0.05
37 – 41 weeks	.031	P > 0.05	-.288	**P < 0.05**	-.055	P > 0.05	.227	P > 0.05	.208	P > 0.05

Table 9. Correlation of preterm and term with type of Cerebral Palsy

Correlation Gestational Age at Birth	Spasticity		Non Spasticity	
	r value	P value	r value	P value
Preterm (22-36weeks)	.333	P < 0.05	-.333	P < 0.05
Term (37-41 weeks)	-.333	P < 0.05	.333	P < 0.05

Table 10. Correlation of Gestational Age at Birth and Type Of Cerebral Palsy

Gestational Age at Birth	Spasticity		Non Spasticity	
	r value	P value	r value	P value
22 – 27 weeks	0.00	P > 0.05	0.00	P > 0.05
28 – 31 weeks	0.085	P > 0.05	-0.085	P > 0.05
32 – 36 weeks	0.315	P < 0.05	-0.315	P < 0.05
37 – 41 weeks	-0.333	P < 0.05	0.333	P < 0.05

The distribution of tenuous arterial supply has been termed parasagittal. This zone is the primary location of ischemic injury in prolonged partial asphyxia . An acute, near-total intrauterine asphyxia at the end of labor shows a consistent pattern of injury in subcortical brain nuclei, including the thalamus, basal ganglia and brainstem in contrast with the relative sparing of the cerebral cortex and white matter. The distribution of injury in these infants reflects the hierarchy of metabolic needs that are unmet after severe, sudden disruption of substrate supply as occurs in an acute, severe asphyxia. The higher metabolic rate of subcortical nuclei compared with cerebral hemispheres explains the preponderance of subcortical damage. But, in preterm infants gestational age at birth 32-36 weeks with the spastic group type of CP was found a significant correlation and negative significant correlation was found with the non spastic type of CP. The reason was explain above, And within the preterm infants gestational age at birth 28-31 weeks there was no significant correlation was found with the spastic or non spastic group of CP, because the sample size for this gestation weeks was only 1 CP children, And within group of extremely preterm (22-27 weeks) infants could not be correlated because I didn't found any subjects in this gestational weeks. There was no significant correlation between the term and preterm infants gestational weeks at birth with sub types (unilateral, diplegic, quadriplegic, athetoid & ataxic) of CP. Except the gestation weeks 37-41 weeks that are significant negative correlation with the Diplegic sub type of CP children.

The reason could be because within diplegic group more number of CP children comparison to other sub group of CP children. One important finding in the present study was that the majority of infants with CP were born at term 38(76%) and only 12 (24%) before 37 weeks of gestation, which shows that CP is mainly an issue of term infants. And my result is similar to previously done research by Soleimani *et al.*[3] As I mentioned earlier, the most susceptible region to hypoxic/ischemic damage changes as the infant matures. [2] This could be a possible explanation for the correlation between term GA and type CP. Another finding of my study was that the number of male percentage cerebral palsy children was more than the female cerebral palsy children, that is i.e. (male=66% and female=34%) out of total subjects. This finding co-inside with the finding of previous research were similar result was obtained and it was proved in that study that, the risk of CP in premature males was higher than that in females.[3]

CONCLUSION

A significant correlation was found between the GA and type and distribution of cerebral palsy. In preterm infants spastic CP is predominant. In term infants the non-spastic form of CP is more prevalent than in preterm infants. Significant negative correlation was found between doctors, and sub type of CP in diplegic sub group. There was no significant correlation between the mother age at conception in different age groups. One important finding in the present study was that the majority of infants with CP were born at term which shows that CP is mainly an issue of term infants. Another finding of my study was that the risk of CP in males was higher than that in females.

REFERENCES

Rosenbaum P, Paneth N,LevitonA,*et al* Proposed definitions and classification of cerebral palsy April 2005. Devlopmental Medicines & Child Neeurology 2005,47:571-576

Broeck C, Himpens E,*et al*. Influence of gestational age on the type of brain injury and neuromotor outcome in high risk neonates October 2007, Eur J Pediatr, DOI 10.1007/s00431-007-0629-2

Soleimani F, Vameghi R *et al*. Risk factors Associated with Cerebral palsy children born Eastern and Northern Districts of Tehran, 2010, Iranian Red Crescent Medical journal, 12(4):428-433

Joseph K.S, Alexander C,*et al*. Does the risk of cerebral palsy increase or decrease with increasing gestational age ? December 2003 BMC Pregnancy and Childbirth 2003,3:8

Richard E., Robert M, Nelson Textbook of Pediatrics, High Risk Pregnancies, Chapter 84, 17th edition (May2003)

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