Risk Factors of Cerebral Palsy among the Children Attending a Children's Hospital

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ABSTRACT

Background: Cerebral Palsy is a disorder of movement and posture caused by nonprogressive abnormal brain function. It is a lifelong condition and one of the most common causes of physical disability in children. The objective of this study was to find out the risk factors associated with cerebral palsy among children.

Methods: A case control study was carried out among 330 children where cases and controls were taken in the ratio of 1:2. Cases included children diagnosed with cerebral palsy and attending neurological out-patient department of a Children's Hospital in Kathmandu, Nepal and control included children not having cerebral palsy and attending medical out-patient department of the same hospital for other medical problems. The data were collected from November 29, 2017 to May 20, 2018 by using a pretested interview schedule. The findings were analyzed using frequency, percentage, mean, standard deviation and chi square test and odds ratio.

Results: Findings revealed that about one-fourth (24.5%) cases were diagnosed to have CP within one year of age. In terms of sex majority (63.6%) of the cases were male and majority were the first born children. Findings also revealed that infection during pregnancy (OR:2.9, CI: 1.1-7.5), family history of cerebral palsy (OR:5.6, CI: 1.4-21.8), instrumental delivery (OR: 10.9, CI:2.3-50.6), not crying immediately after birth (OR: 17.3, CI: 8.6-34.6), were significantly associated with cerebral palsy.

Conclusions: Most of the identified risk factors are preventable and controllable through proper antenatal and skilled intranatal care. Thus, every pregnant woman should receive proper care during pregnancy as well as during delivery for the prevention of the identified risk factors.

Keywords: Cerebral palsy; children; risk factors

INTRODUCTION

Cerebral palsy (CP) is a neurodevelopmental disorder characterized by abnormality of muscle tone, movement and motor skills.[1] CP is caused by injury to the developing brain during fetal or infancy period.[2] The prevalence of CP in India is 2.83/1000 children among the age-group of birth to 19 years.[3] The prevalence of CP in Nepal is 15%.[4] In terms of gestational age, CP is highest in children born before 28 weeks of gestation.[5] With advancements in modern medicine, the increased survival of preterm babies has lead to increased incidence of cerebral palsy.[6] Several maternal, antenatal and intrapartum factors increase the risk for CP in infants.[7]

Identification and avoidance of such risk factors can lower infants neurologic morbidity. Thus, the purpose of this study was to identify the association of selected maternal and child characteristics with CP among children. Identification of the risk factors of CP would help in formulating preventable strategies of cerebral palsy.

METHODS

This study used matched case control design to identify the risk factors associated with cerebral palsy. Cases included the children aged between 1 to 14 years and attending the neurology OPD of Kanti Children Hospital Maharajgunj, Kathmandu and diagnosed as having cerebral palsy but not having congenital anomalies or other neurological problem. Age (±6month) and sex matched children attending the medical OPD of Kanti Children Hospital Maharajgunj, Kathmandu for medical problems with no diagnosis of CP were selected as the controls for the study. Data were collected from November 29, 2017 to May 20, 2018. Sample size was calculated by taking the prevalence rate of 15%[4]

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allowable error as 5%. Cases and control were taken in the ratio of 1:2 thereby resulting into the number of cases to be 110 and controls to be 220 with total as 330.

Before commencement of data collection, Ethical clearance for the study was obtained from Nepal Health Research Council and Institutional Review Committee of Kanti Children's Hospital Maharajgunj, Kathmandu. Informed consent was obtained from the mothers of the children of both the cases and controls. Data were collected from mothers of the children using a structured interview schedule consisting of two parts i.e. questions related to socio-demographic information of mother's and child and questions related to CP. Confidentiality was maintained by not revealing the identity of the respondents anywhere in the report and by conducting the interview in a separate quiet place of the hospital. After finishing the interview each respondent's queries regarding the cerebral palsy were answered. Collected data were edited and coded. The coded data were entered and analyzed in SPSS version 16. The analyzed data from cases and controls were presented in terms of frequency, percentage, mean and standard deviation. Chi-square test was applied to test the significance of the association of maternal and child related factors among cases and control at 95% Confidence Level ($p<0.05$) and odds ratio was calculated.

RESULTS

Table 1 shows that about one-fourth (24.5%) cases were diagnosed to have CP within one year of age. In terms of sex, majority (63.6%) of the cases were male and majority were the first born children. Only few 7.3% of the cases had family history of CP. Almost all (94.5%) cases were delivered in hospital. About three fourth of the cases (76.4%) were delivered normally and almost all (93.6%) were born at term and 82.7% had the birth weight of 2.5 kg or more. In all these characteristics controls were somewhat similar to cases.

Table 1. Child Characteristics among Cases and Controls. (n=330)		
Variables	**Cases (n=110) No. (%)**	**Controls (n=220) No. (%)**
Age in months#		
Up to 12 months	27(24.5)	54(24.5)
13-36 months	52(47.3)	104(47.3)
37-72 months	24(21.8)	48(21.8)
73 and above months	7(6.4)	14(6.4)
Sex		
Male	70(63.6)	140(63.6)
Female	40(36.4)	80(36.4)
Birth Order		
First	75(68.2)	142 (64.5)
Second and more	35(31.8)	78 (35.5)
Family history of CP		
Present	8(7.3)	3(1.4)
Absent	102(92.7)	217(98.6)
Place of delivery		
Hospital	104(94.5)	208(94.5)
Home	6(5.5)	12(5.5)
Type of delivery		
Normal	84(76.4)	184(83.6)
Vacuum/Forceps	10(9.1)	2(0.9)
CS	16(14.5)	34(15.5)
Gestational age		
Preterm	7(6.4)	13(5.9)
Term	103(93.6)	207(94.1)
Birth weight		
Less than 2.5 Kg	19(17.3)	23(10.5)
≥ 2.5 Kg	91(82.7)	197(89.5)

#Mean age ± SD in cases 26.52±14.32 and controls 26.63±13.87

Table 2 depicts that almost three-fourth (72.7%) of mothers in the case group and (78.2%) of the mothers in control group belonged to below 30 years of age group. Regarding education, about one third (32.7%) of the mothers of cases and 36.4% of the mothers of controls had education above SLC. Almost all (93.6%) of the mothers of cases and 83.6% of the mothers of controls were homemaker. Almost all of the mothers of cases and control (96.4% and (99.1%) respectively had no history of multiple pregnancy. Only 10.0% of the mothers of cases and 3.6% of the mothers of controls had fever during pregnancy. Only 0.9% of the mothers of cases and none of the mothers of control used cigarette smoking during pregnancy.

Table 2. Maternal Characteristics of Cases and Controls. (n=330)		
Variables	**Cases (n=110) No. (%)**	**Controls (n=220) No. (%)**

Age in completed years		
below 30	80 (72.7)	172 (78.2)
30 and above	30 (27.3)	48 (21.8)
Education		
Iliterate	13 (11.8)	26 (11.8)
Primary	14 (12.7))	16 (7.3)
Secondary	21 (19.1)	39 (17.7)
SLC	26 (23.6)	59 (26.8)
Above SLC	36 (32.7)	80 (36.4)
Occupation		
Home maker	103(93.6)	184 (83.6)
Agriculture	3 (2.7)	6 (2.7)
Service	3 (2.7)	9 (4.1)
Business	0 (0.0)	9(4.1)
Others	1 (0.9)	12 (5.5)
Multiple pregnancy		
Yes	4(3.6)	2 (0.9)
No	106(96.4)	218 (99.1)
Infection during pregnancy (Fever)		
Yes	11(10.0)	8(3.6)
No	99 (90.0)	212 (96.4)
Smoking during Pregnancy		
Yes	1 (0.9)	-
No	109 (99.1)	220 (100.0)

Table 3 presents childhood problems of cases and controls. Higher proportion (8.2%) of cases and 0.5% of controls had history of birth injuries. Similarly 50% of cases did not cry immediately after birth as against to 5.5% of controls. Majority (63.6%) of cases had history of convulsion as against 1.8% of controls. Most of the cases as well as controls (82.7% and 88.6%) respectively had not suffered from neonatal jaundice. Regarding fall injury, all cases and almost all controls (100% and 97.3%) respectively had not experienced fall injury. Most of the cases (91.8%) and controls (99.5%) had not suffered from meningitis.

Table 3. Childhood Problems of Cases and Controls. (n=330)		
Variables	**Cases (n=110) No. (%)**	**Controls (n=220) No. (%)**
History of Birth injuries		
Present	9(8.2)	1(0.5)
Absent	101(91.8)	219(99.5)
History of Cry immediately after birth		
Yes	55(50.0)	208(94.5)
No	55(50.0)	12(5.5)
History of Convulsion		
Yes	70(63.6)	4(1.8)
No	40(36.4)	216(98.2)
History of Neonatal Jaundice		
Present	19(17.3)	25(11.4)
Absent	91(82.7)	195(88.6)
History of Fall Injury		
Yes	-	6 (2.7)
No	110 (100.0)	214 (97.3)
History of Meningitis		
Yes	9 (8.2)	1 (0.5)
No	101 (91.8)	219 (99.5)

Table 4 represents child characteristics and its association with cerebral palsy. There was significant association between family history of CP and cerebral palsy, (p= 0.008 (OR 5.673; 95%CI, 1.474-21.832). Babies who had family history of CP were 5.6 times more likely to have Cerebral Palsy than those who didn't have family history of CP. Likewise, a significant association between instrumental delivery and CP, (p = 0.00) (OR 10.900; 95%CI, 2.345-50.668). Babies who had instrumental delivery were 10.9 times more likely to have CP than those who didn't have instrumental delivery. A significant association was also found between babys crying immediately after birth and CP (p= 0.000) (OR 17.333; CI, 8.680-34.612). Babies who didn't cry immediately after birth were 17.3 times more likely to have CP than those who cried immediately after birth.

There was no significant association of place of delivery, gestational age, birth weight and neonatal jaundice with cerebral palsy.

Table 5 depicts association of maternal characteristics with CP A significant association was found between infection during pregnancy (fever) and cerebral palsy (p=0.019) (OR 2.944; 95%CI, 1.149-7.549). Babies whose mother had infection(fever) during pregnancy were 5.6 times more likely to have Cerebral Palsy than those who didn't have maternal infection during pregnancy. There was no significant association of maternal education and multiple pregnancy with cerebral palsy.

Table 4. Association of Child Characteristics with Cerebral Palsy. (n=330)

Variables	Cases (n=110) No. (%)	Controls (n=220) No. (%)	p Value	OR (95.% C.I.)
Family history of CP				
Present	8(7.3)	3(1.4)	**0.008*c**	5.673(1.474-21.832)
Absent	102(92.7)	217(98.6)		Reference
Place of delivery				
Hospital	104(94.5)	208(94.5)	1.000 a	1.000(0.365-2.740)
Home	6(5.5)	12(5.5)		Reference
Instrumental Delivery				
Yes	10(9.1)	2(0.9)	**0.000*c**	10.900(2.345-50.668)
No	100(90.9)	218(99.1)		Reference
Gestational age				
Preterm	7(6.4)	13(5.9)	0.870 a	1.082(0.419-2.795)
Term	103(93.6)	207(94.1)		Reference
Birth Weight				
Less than 2.5 Kg	19(17.3)	23(10.5)	0.080a	1.788(0.928-3.448)
≥ 2.5 Kg	91(82.7)	197(89.5)		Reference
Cry immediately after birth				
Not cried	55(50.0)	12(5.5)	**0.000*a**	17.333(8.680-34.612)
Cried	55(50.0)	208(94.5)		Reference
Neonatal Jaundice				
Present	19(17.3)	25(11.4)	0.137 a	1.629(0.853-3.108)
Absent	91(82.7)	195(88.6)		Reference

a:Pearson's Chi Square Test, b: Contuinity Correction, c :Fisher Exact Test, *: p Value Significant ≤ 0.05

Table 5. Association of Maternal Characteristics with Cerebral Palsy. (n=330)

Variables	Cases (n=110) No. (%)	Controls (n=220) No. (%)	p Value	OR (95.% C.I.)
Education				
Iliterate	13 (11.8)	26 (11.8)	1.000 a	1.000(0.492-2.032))
Literate	97 (88.2)	194 (88.2)		Reference
Multiple pregnancy				
Yes	4 (3.6)	2 (0.9)	0.098 c	4.113(0.742-22.814)
No	106 (96.4) (96.4)	218 (99.1)		Reference
Infection during pregnancy				
Yes	11 (10.0)	8 (3.6)	**0.019*c**	2.944(1.149-7.549)
No	99 (90.0)	212 (96.4)		Reference

a:Pearson's Chi Square Test, b: Continuity Correction, c :Fisher Exact Test, : p Value Significant ≤ 0.05

DISCUSSION

Present study, found a significant association between family history of CP and cerebral palsy, (p= 0.008 (OR 5.673; 95%CI, 1.474-21.832). Babies who had family history of CP has 5.6 times higher odds of having CP than those who didn't have family history of CP. It is supported by the study conducted in Norway on Familial risk of cerebral palsy which revealed that if sibling in the family is affected then the risk of a child having CP is increased by 9.2 times, (OR= 9.2 CI-6.4-13).[8] It is also supported by another study in which Consanguinity and birth deficits in other family members were positively associated with cerebral palsy (OR = 4.62; 95% CI: 2.07-10.3 and OR = 12.7; 95% CI: 3.13-51.7 respectively).[9] There might be some genetic factor that may have been transmitted in the family and may be the cause of occurrence of CP in the Child.

Instrumental delivery was also significantly associated with CP (p = 0.00) (OR 10.900; 95%CI, 2.345-50.668). Babies who had instrumental delivery has 10.9 times higher odds of having CP than those who didn't have instrumental delivery. This finding is similar to the findings of the study conducted in Sweden which reveal that children delivered through instrumental delivery were 1.9 times more (OR 1.9,95%CI 1.6-2.3) likely to have cerebral palsy.[10] During instrumental delivery the child might have some injuries in the scalp and brain which may be the reason for the development of cerebral palsy in children delivered through instrumental delivery.

There was significant association between lack of baby crying immediately after birth and CP (p= 0.000) (OR 17.333; CI, 8.680-34.612). This study showed that the babies who didn't cry immediately after birth has 17.3 times higher odds of having CP than those who cried immediately after birth. This finding is supported by the finding of the study conducted in Sweden which revealed that babies with low APGAR score at birth were 62 times more at risk of developing CP (OR-62 95%CI 52-74) .[10] It is further supported by a cohort study done in California which revealed that children having birth asphyxia have 5.9 times more risk of having cerebral palsy (OR-5.9 CI 5.3-6.6).[11] Conditions such as asphyxia, late cry, low apgar score represents lack of oxygen in the brain cells which may be one of the reasons for the brain damage and development of CP.

The present study did not find any association of gestational age with the occurrence of CP. In contrast to this finding, a study conducted in Sweden revealed that children delivered in 32-36 weeks of gestation were 3.9 times more likely to have CP.[10] This may be

because of sample variability and very few proportion of the sample were preterm, so it may not have been represented appropriately.

In the present study, birth weight of baby was not significantly associated with CP. However in contrast to this finding a study done in Palestinian children revealed a significant association between low birth weight and incidence of CP. Low birth weight babies had 4.6 times more chance of developing cerebral palsy (OR-4.6, CI-2.6-8.1).[12] Brain development of the low birth weight babies might have been affected which may be the reason for the development of cerebral palsy.

This study also found no significant association between neonatal jaundice and cerebral plasy. In contradiction to this finding, a study conducted in Turkey found that there was a significant association between neonatal jaundice and cerebral palsy. A child having severe neonatal hyperbilirubinemia seemed to be 43.94 times more likely to have cerebral palsy.[2] In Hyperbilirubinemaia, when the biliribun level increases in the blood it may cross the blood brain barrier leading to brain damage which may be the possible reason for development of cerebral palsy.

In the present study, there was a significant association between infection (fever) during pregnancy and CP, (p=0.019) (OR 2.944; 95%CI, 1.149-7.549). Babies whose mother had infection(fever) during pregnancy has 5.6 times higher odds of having CP than those who didn't have maternal infection(fever) during pregnancy. This finding is supported by a study conducted in Washingorn state, which reveals that babies from mothers who had perinatal infection were 3.1 times more likely to develop CP (OR-3.1, 95%, CI-2.3-4.2).[13] Children who were born from the mother who had infection during pregnancy might have acquired infection through mother in the intrauterine life and which may have been a reason for development of CP.

According to the present study, multiple pregnancy is not significantly associated with CP. However in a case control study conducted in Palestinian children revealed significant association between multiple birth and incidence of CP. Children having multiple birth were 11.4 times more likely to have CP (OR-11.4, CI-2.5-53.0).[12] In multiple pregnancy the babies might not have got enough space and nutrient required for the proper growth and development of babies which might have been the reason for development of CP.

CONCLUSIONS

On the basis of the findings and discussion it is concluded that infection during pregnancy, family

history of cerebral palsy, instrumental delivery and not crying immediately after birth are the risk factors of CP. Majority of these risk factors are preventable and controllable with the joint effort of individual, family, health personnel, health organization and government.

This study couldn't find any association of gestational age, birth weight, neonatal jaundice and multiple pregnancy with CP. So, further study is recommended to look into these potential factors.

ACKNOWLEDGEMENTS

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Competing interests: None declared

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