

## **Risk Factors of Cerebral Palsy among Children Registered in a Self Help Group for Cerebral Palsy**

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### **Abstract**

A case control study was conducted to determine risk factors of cerebral palsy. Fifty children with cerebral palsy registered at a Self Help Group for Cerebral Palsy as cases and 100 age and sex matched controls from immediate neighbourhood of cases were studied. All cases and controls were aged six months to 10 years and residing in Kathmandu valley. Information regarding antenatal, natal and postnatal period was collected by interviewing mothers of cases and controls at their houses and from hospital records of the study subjects where available.

Forty four percent of cases had associated seizure disorder, 22.0% cases had speaking problem and 14.0% cases were mentally retarded. Most common type of cerebral palsy was spastic diplegia (30.0%). Birth asphyxia was found to be present among 48% of cases, 24.0% cases had birth weight of less than 2500 gm and 16.0% cases developed neonatal jaundice. Neonatal sepsis was present in 36.0% cases. The significant risk factors identified with logistic regression were birth asphyxia (odds ratio 21.6), neonatal sepsis (odds ratio 20.8), neonatal jaundice (odds ratio 8.3) and low birth weight (odds ratio 7.1). Study concludes that birth asphyxia, low birth weight, neonatal jaundice and neonatal sepsis tend to be risk factors of cerebral palsy. As these risk factors are modifiable, the burden of cerebral palsy can be reduced by preventing these risk factors. Similarly follow up for high risk cases and early rehabilitative intervention can limit the disability among cases.

### **Introduction**

Cerebral palsy (CP) is a non-progressive neuromotor disorder of cerebral origin with a variable etiology and variation in the severity from minor incapacitation to total handicap. It is one of the leading causes of crippling in children (Shahu, Kapoor, Reddaiah, Singh, & Sundaram, 1997). Besides handicapping the child, CP causes considerable psychological and social trauma and financial burden to the family.

It is estimated that, 1-2 children per 1000 live births develop CP in their later life (Ghai, Gupta & Paula, 2010). In Nepal, with annual live births of 7, 30,000, about 1,400 to 2,100 children annually are estimated to develop CP (UNICEF, 2009). The estimated cases of cerebral palsy in Nepal are approximately 70,000-80,000 (as cited in Surveillance of CP in Europe, 2008).

Cerebral palsy occurs due to brain damage during the first few years of life particularly during pre-natal, peri-natal and early infancy that cannot be cured. As a result of this damage, children with CP suffer throughout their lives (Parajuli, Acharya, & Nyachhyon, 2009).

Studies in developed countries have identified several risk factors of cerebral palsy. These include birth asphyxia, neonatal seizure, **prematurity**, maternal infection during pregnancy, intra uterine growth retardation, neonatal sepsis, neonatal jaundice, major congenital malformation and prolonged rupture of membranes (Erkin, Delialioglu, Ozel, Culha, & Sirzai, 2008; Schlapbach, Aebischer, Adams, & Natalucci, 2011). Such studies are lacking

in developing countries especially in Nepal where modern obstetric and perinatal care are used to a lesser extent compared to developed countries. Therefore a case control study was conducted with the purpose of testing whether the risk of cerebral palsy is higher among children with a) birth asphyxia, b) premature birth, c) neonatal sepsis, d) neonatal jaundice and e) low birth weight.

For the purpose of this study birth asphyxia was defined as absence of immediate cry after birth (as reported by mother) or recorded Apgar score of less than 7 at one minute of birth. Prematurity was defined as delivery of child before 37 weeks of gestation. Neonatal sepsis was defined as having poor sucking, breathing problems, vomiting everything after eating, and convulsion during 28 days of life requiring hospitalization and antibiotics (as reported by mother) or recorded history of neonatal sepsis. Neonatal jaundice was defined as yellowish discoloration on the newborn appearing in the first 24 hours of life or recorded bilirubin level of more than 15 mg/dl and presence of jaundice beyond three weeks after birth. Low birth weight was defined as the birth weight of less than 2500 gram irrespective of gestational age.

## Methodology

Study was implemented after getting approval from the research committee of Maharajgunj Nursing Campus. Study used a case-control study design. Cases included children having cerebral palsy (with presence of spasticity, abnormal muscle tone or ataxia) irrespective of other associated problems (like seizure disorder, mental retardation, visual impairment, and speech or hearing impairment) aged six months to 10 years and registered in Self Help Group for Cerebral palsy (SGCP). SGCP is a non profit, non-governmental organization at Dhapakhel, Lalitpur. There were 67 such children from Kathmandu valley, out of which 50 cases were accessible for data collection.

Controls included age ( $\pm$  six months) and sex matched children without cerebral palsy (i.e.

absence of spasticity, abnormal muscle tone or ataxia) and without seizure disorder or other neuro-developmental disorders and who were residing in the immediate neighborhood of the cases. Exposure of concern was the presence of neonatal risk factors during neonatal period. To increase the power of study, controls were taken at 1:2 ratios from the immediate neighborhoods of case children. The sample size of this study thus came to be 150.

An interview schedule was developed as per the objective of the study. Validity of the instrument was established by consultation with subject experts. Instrument was translated in Nepali and was again back translated into English to ensure that the meaning of questions is retained. Pretesting of the instrument was done among mothers of five children in "A Genuine Effort Group", Kupandole, a rehabilitation centre for children with neurological disabilities. Final instrument consisted of semi structured questions related to socio-demographic information of mothers and case/ control children, CP related questions among cases and questions related to antenatal, birth and neonatal status of case/control children.

Permission to conduct study was obtained from the authority of SGCP through a written request letter. The complete address and telephone number of the selected cerebral palsy cases were noted down from SGCP register. Mothers of cases were contacted through telephone and their informed verbal consent to participate in the study was obtained. Data were collected by the principal author by interviewing the mothers of case and control children at their homes from August to September, 2011.

Collected data were edited, coded and entered in SPSS 16 version and analyzed by using descriptive statistics namely frequency, percentage, mean, standard deviation and inferential statistics namely chi-square and binary logistic regression at five percent level of significance. Odds ratio was used to find out

the strength of association between risk factors and cerebral palsy.

**Findings**

Findings of the study are presented in the form of tables. Table 1 presents the socio-demographic information of the mothers of case and control children. Table 2 presents the demographic information of case and control children. Table 3 presents the CP related information of cases. Table 4 presents the neonatal factors among cases and controls. Table 5 and 6 presents the univariate and multivariate

analysis of risk factors respectively.

Table 1 reveals that majority of mothers among cases (76.0%) and controls (73.0%) were of 20-30 years age group when the child was born. Sixty six percent of the respondents among cases were under SLC as compared to 43.0% of respondents among controls. Majority (64.0%) of the respondents in total was from Kathmandu. Majority of cases and controls (62.0% and 59.0% respectively) belonged to Brahmin/Chhetri ethnicity.

**Table 1**

**Socio-demographic Information of Mothers of Cases and Controls**

\* Mean age of mothers ±SD was 25.8 yrs ± 4.37 in cases and 25.8 yrs ± 4.47 in controls

Variable	Cases (n=50) Percent	Controls (n=100) Percent	Total (n=150) Percent
<b>Age (in yrs) when the child was born*</b>			
< 20	8.0	14.0	12.0
20 to 30	76.0	73.0	74.0
≥30	16.0	13.0	14.0
<b>Education</b>			
Under SLC	66.0	43.0	50.6
SLC and above	34.0	57.0	16.7
<b>Residence</b>			
Kathmandu	64.0	64.0	64.0
Lalitpur	22.0	22.0	22.0
Bhaktapur	14.0	14.0	14.0
<b>Ethnicity</b>			
Brahmin/Chhetri	62.0	59.0	60.0
Advantaged Janajati	28.0	33.0	31.3
Disadvantaged janajati	10.0	8.0	8.7

Table 2 shows majority of cases as well as controls were first born children and were in the age

group of up to five years. Sixty percent of the cases as well as controls were male. Four percent among cases and five percent among

controls had positive family history of cerebral palsy (not shown in the table)

**Table 2**  
**Demographic Information of the Case and Control Children**

Variables	Cases (n=50) Percent	Controls (n=100) Percent	Total (n=150) Percent
<b>Birth order</b>			
First	60.0	57.0	58.0
Second	34.0	32.0	32.7
Third and above	6.0	11.0	9.3
<b>Age (in months)*</b>			
Up to 12	8.0	6.0	6.7
12-60	52.0	55.0	54.0
60-120	40.0	39.0	39.3
<b>Sex of child</b>			
Male	60.0	60.0	60.0
Female	40.0	40.0	40.0

\*Mean age  $\pm$  SD was 60.8 months  $\pm$ 29.8 in cases and 60.2 months  $\pm$  29.3 in controls

**Table 3**  
**Cerebral Palsy Related Information of Cases**  
**n=50**

Variables	Percent	Variables	Percent
<b>Type of CP</b>		<b>Age when CP diagnosed</b>	
Spastic diplegia	30.0	One month to six months	14.0
Dystonic	20.0	Six months to one year	70.0
Spastic hemiplegia	10.0	One year to two years	16.0
Spastic quadriplegia	18.0	Mean $\pm$ SD	10.8 $\pm$ 4(mths)
Athetoid	10.0	<b>Associated Conditions</b>	
Ataxic	2.0	Seizure disorder	44.0
Mixed	6.0	Speaking problem(dumbness)	22.0
Unidentified	4.0	Learning disability(MR)	14.0
		Hearing problem(deafness)	4.0
		Visual problem (blindness)	4.0
		None	12.0

Table 3 reveals that nearly one-third (30.0%) of the cases were spastic diplegic followed by dystonic (20.0%). Most (84.0%) of the cases were diagnosed to have CP by one year of age.

Forty four percent of the cases had associated seizure disorder, 22.0% had speaking problem and 14.0% of the cases had learning disability.

**Table 4:**  
**Distribution of Neonatal Factors among Cases and Controls**

Variables	Cases (n=50) Percent	Controls (n=100) Percent	Total Percent
<b>Preterm at birth</b>			
Yes	10.0	7.0	8.0
No	90.0	93.0	92.0
<b>Low birth weight( &lt;2500gm)</b>			
Yes	24.0	8.0	13.3
No	76.0	92.0	86.7
<b>Birth asphyxia in child</b>			
Yes	48.0	6.0	20.0
No	52.0	94.0	80.0
<b>Hospitalization during neonatal period</b>			
Yes	42.0	2.0	15.3
No	58.0	98.0	84.6
<b>Neonatal sepsis</b>			
Yes	36.0	3.0	14.0
No	64.0	97.0	86.0
<b>Neonatal jaundice</b>			
Yes	16.0	2.0	7.0
No	84.0	98.0	93.0

Table 4 shows that 10 % of cases and 7% of controls were preterm. In regards to birth weight 24% of cases were low birth weight as against 8% of controls. In regards to birth asphyxia, 48% of cases had birth asphyxia as

against only 6% of controls. Likewise 42% of cases were hospitalized during neonatal period as against 2% of controls. Similarly 36% of cases and 3% of controls had

developed neonatal sepsis and 16.0% of cases and 2% of controls had developed neonatal jaundice.

**Table 5:**

Risk factors	Cases (n=50) No.(%)	Controls (n=100) No. (%)	OR (95% CI)	p-value
<b>Prematurity</b>				
Yes	5(41.0)	7(59.0)	1.4 (0.4-4.9)	0.53
No	45(32.7)	93(67.3)		
<b>Low birth weight</b>				
Yes	12(60.0)	8(40.0)	3.6(1.4-9.6)	0.007
No	38(29.0)	92(71.0)		
<b>Neonatal sepsis</b>				
Yes	18(85.0)	3(15.0)	18.2(5.0 - 65.8)	<0.001
No	32(24.8)	97(75.2)		
<b>Birth asphyxia</b>				
Yes	24(80.0)	6(20.0)	14.4(5.3 - 39.1)	<0.001
No	26(21.6)	94(79.4)		
<b>Neonatal jaundice</b>				
Yes	8(80.0)	2(20.0)	9.3(1.9-45.8)	0.004
No	42(30.0)	98(70.0)		

### Univariate Analysis of Risk Factors of Cerebral Palsy

Table 5 reveals a significant association of birth asphyxia ( $p < 0.001$ ), neonatal sepsis ( $p < 0.001$ ), low birth weight ( $p < 0.007$ ) and neonatal jaundice ( $p < 0.004$ ) with cerebral palsy. Table also presents the odds ratio (OR) and the 95.0% confidence interval (CI) for OR which is highest with neonatal sepsis 18.2 (5.0 - 65.8) followed by birth asphyxia 14.4 (5.3 - 39.1).

**Table 6**  
Multivariate Analysis of Risk Factors of Cerebral Palsy

Risk factors	Adjusted OR (95%CI)	p-value
Birth asphyxia	21.6 (6.8 - 68.5)	<0.001
Neonatal sepsis	20.8 (4.8-90.8)	<0.001
Neonatal Jaundice	8.3 (1.2 - 59.9)	0.035
Low birth weight	7.1 (2.1 - 24.0)	0.002

Table 6 presents the result of multivariate analysis of those risk factors which were found to be significant in univariate analysis. Step wise logistic regression was used for the multivariate analysis. The adjusted odds ratio was highest with birth asphyxia 21.6 (6.8 - 68.5) followed by neonatal sepsis 20.8 (4.8-90.8).

### Discussion and Conclusions

In this study majority of mothers among cases and controls (76.0% and 73.0% respectively) belonged to age group 20-30 years when the case or control children were born. Higher proportion (60.0%) of mothers of cases had under SLC in compare to 47.0% of mothers among controls. Majority of the mothers among cases and controls (62.0 and 59.0% respectively) were Brahmin/Chhetri.

Majority of cases (60.0%) and controls (57.0 %) were first born children. Four percent among cases and five percent among control children had positive family history of cerebral palsy. Majority of the cases and controls (60% each) were male.

About the risk factors, no significant association was found between prematurity and cerebral palsy in this study which is in contradiction with finding of the study done by Erkin et al. (2008) and Schlapbach et al. (2011) reported prematurity as a risk factor of CP. Likewise Murphy, Johnson, Sellers & MacKenzie (1995) found that the frequency of cerebral palsy decreased with increasing gestational age. This contradiction in the present study may probably be due to small sample size.

In this study low birth weight was found to be a significant risk factor of CP ( $P = 0.002$ ) with adjusted OR 7.1 (2.1 - 24.0). This finding is in an agreement with the findings of Shahu et al. (1997) which revealed OR for low birth weight 13.8 (4.95 - 38.3). Similar findings have been reported by other studies (Erkin et al., 2008; Schlapbach et al., 2011).

Birth asphyxia was found to be a significant risk factor of cerebral palsy in this study ( $p < 0.001$ ) with adjusted OR 21.6 95% CI (6.8 - 68.5) which is consistent with the finding of Shahu et al. (1997) which revealed multivariate OR for birth asphyxia 36.1 (7.76 - 160). Studies by Erkin et al. (2008) and Schlapbach et al. (2011) have also reported that birth asphyxia is a significant risk factor of cerebral palsy. Though birth asphyxia is seen as a significant risk factor for development of CP, Shahu et.al (1997) reported that it was responsible for only 25.0% cases where as it was 48.0% in the current study. Regarding neonatal sepsis 36.0% of case children had developed neonatal sepsis and was significantly associated with CP ( $p < 0.001$ ) adjusted OR 20.8 (4.8-90.8). Similar result has been reported by Shahu et al. (1997) where OR

for neonatal sepsis was 24.9 (2.78 - 22.3). Erkin et al. (2008) and Schlapbach et al. (2011) also reported similar findings.

Sixteen percent of case children in this study had developed pathological jaundice during neonatal period and pathological jaundice during neonatal period was found to be a significant risk factor for development of CP ( $P=0.035$ ) adjusted OR 8.3 CI (1.2 - 59.8). Shahu et al. (1997) also reported neonatal jaundice as a risk factor of CP with OR 14.4 (3.69 - 56.4). Pandey, Bhattarai, & Ellis, (1998) reported that among 41 cerebral palsy cases, three had strong evidence of hyperbilirubinaemia and the characteristic dyskinetic type of CP.

On the basis of findings of the study it is concluded that birth asphyxia, neonatal sepsis, low birth weight and neonatal jaundice are the risk factors of CP. The risk factors for cerebral palsy identified in this study are potentially modifiable. Low birth weight can be prevented by promoting factors such as maternal nutrition birth spacing and reducing parity, like wise birth asphyxia to some extent can be reduced by improving obstetric and neonatal care during delivery. Early intervention in case of infection and neonatal jaundice can reduce the time of exposure of the developing brain to these adverse factors can be reduced. Low birth weight has a high prevalence in developing countries like Nepal and it has direct as well as indirect influence on the incidence of CP as it gives rise to certain other risk factors like birth asphyxia and neonatal infection. So the maximum effect in reduction of CP would probably be achieved by reducing the incidence of low birth weight.

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