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Original Research Article

Etiology of cerebral palsy in children below age of 5 years

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ABSTRACT

Background: Cerebral palsy is the most common and costly form of chronic motor disability that begins in childhood. Aims of the study were to identify etiology and risk factors of CP*, to find correlation between the etiology and clinical type of CP* in children below age of 5 years.
Methods: analytical study done in indoor patients at civil hospital, Ahmedabad from October 2014 to September 2016.
Results: Overall incidence of cerebral palsy in indoor patients was 0.78 per 100 patients. Most common age of presentation is 1-3 years. Majority of cases have perinatal factors as etiology followed by postnatal etiology. Most common type of CP was spastic type. Most common type of topographical CP was spastic quadriplegic. Major symptom for which they admitted in the hospital was convulsion.
Conclusions: Majority of cases had perinatal factors as etiology author can prevent CP* by providing primary prevention, specific prevention and improving antenatal and intra-natal care. Disease progression of CP* can be halted by secondary prevention. Maximization of function can be done by tertiary prevention.

Keywords: Cerebral palsy, Etiology, Perinatal, Postnatal, Quadriplegia, Spastic

INTRODUCTION

Cerebral palsy is a well-recognized neurodevelopmental condition beginning in early childhood and persisting through the lifespan. Cerebral palsy has substantial effects on function and health related quality of life of patients and their cares.

Cerebral palsy is a diagnostic term used to describe a group of permanent disorders of movement and posture causing activity limitation that are attributed to nonprogressive disturbances in the developing fetal or infant brain. the motor disorders are often accompanied by disturbances of sensation, perception, cognition, communication and behavior as well as by epilepsy and secondary musculoskeletal problems. Centers for disease control and prevention indicate that the incidence of CP* is 3.6 per 1,000 children.[1-3]

During the past 20 years, there have been increases in incidence and prevalence of CP* that may be related to improved documentation of cases by national registries, advances in neonatal care, or other factors. CP* results from an injury in the developing central nervous system which can occur in utero, during delivery or during the first 2 years of life. CP* is caused by a broad group of developmental, genetic, metabolic, ischemic, infectious and other acquired etiologies that produce a common group of neurologic phenotypes. The peripheral manifestation depends on the magnitude, extent and location of the insult that causes the irreversible damage to the central nervous system. Vast number of factors including antenatal, natal and postnatal factors contributing to development of CP*.

Accurate determination of etiology of CP* whether there is a malformation, genetic etiology, or injury and whether

injury is due to an acquired, or antenatal, natal or postnatal process has obvious significance from the point of view of assessment of recurrence risk, counseling of families and implementation of prevention programs.

As a result of injury to the brain, these children have motor defects which will affect them for their entire lifetime. The problems involved are complex; not only do these children have problems of mobility and loco motor developmental delay, but they can also have seizure disorders, gastrointestinal system problems, learning and perceptual difficulties, visual problems, hearing problems, and growth deficiency.

Treatment is not a cure but to alleviate disability, prevent deformities, achieve maximum possible functions in terms of communication, mobility, independence, education and lead to a near normal life. It is a multidisciplinary approach along with active participation of parents. Motor, mental, speech, vision, hearing and psychological disabilities should be assessed and treated. Surgical management can be used to reduce spasticity and improve mobility. Aims and objectives of the study was to identify etiology and risk factors of cerebral palsy and to find correlation between the etiology and clinical type of cerebral palsy.

METHODS

All patients clinically diagnosed as cerebral palsy and admitted in department of pediatrics, civil hospital, Ahmedabad were included in the study. Study design was analytical study. Study period was September 2014 to august 2016.

Inclusion criteria

- All children below age of 5 years admitted in civil hospital, Ahmedabad diagnosed as cerebral palsy were included in study.
- There was no active neurological disease in the study.
- Children who were having persistent disorder of movement and posture appearing early in life due to a non-progressive disorder of brain were included in the study.

Exclusion criteria

- Children of diagnosed case of cerebral palsy aged >5 years, age <6 months.
- Child having active neurological disease during study excluded from study.

A detail history regarding prenatal, natal and postnatal events were asked and etiology was grouped under antenatal, natal, postnatal or idiopathic.

Antenatal- were various events from conception to the onset of labour including, risk factors and diseases of mother were noted.

perinatal- were events from onset of labour and the various processes involved in the birth process. Intra-natal events (e.g. prolonged labour) history of resuscitation and other immediate postnatal events were noted. Immediate history of NICU admission and events were noted.

Postnatal- were those events affecting the brain after birth. History of NICU admission, indication, course, complications and outcome of events during NICU admission were noted.

Past history of admission or any events noted.

Family history was taken in detail about the number of children, the deaths, abortions on the maternal and paternal side and any neurologically abnormal or mentally retarded child in the family.

Complete physical examination with special attention to neurological examination was carried out, including developmental assessment. After neurological examination they were classified as spastic, hypotonic, ataxia, athetosis or mixed. And the spastic types were further classified according to topographical classification as monoplegic, diplegic, quadriplegic, hemiplegic. Patients were classified according to Gross Motor Functional Classification System (GMFCS). muscle charting was carried out in all patients with cerebral palsy.

Patients with complaints of convulsion had been investigated for EEG. Other investigations include like BERA examination had been carried out for deafness in all patients. Ophthalmology examination was carried out in all patients. Neuroimaging (MRI) was advised in case of etiology has not been found from history, physical examination. After examination and diagnosis of a case of cerebral palsy, proper supportive and symptomatic treatments were given and were advised to attend physiotherapy at department of physiotherapy.

RESULTS

Incidence of cerebral palsy in children

Total admissions during study period were 12468. Out of which, 97 were patients of cerebral palsy. Thus, the incidence of CP in hospitalized children in the present study was 0.78%.

Sex distribution

Out of total 97 patients of cerebral palsy, 58(59.79%) were males and 39(40.21%) were females. In the present study, male to female ratio is 1.48:1.

Most common age of presentation to the hospital was between 1-3 years. 59(60.82%) of the patients of age

group 1-3 years came for specific treatment to this hospital.

Birth order

There were 88.66% patients were 1st to 3rd born while 11.34% patients were of birth order of 4 and above with predominance of 2nd born (42.27%).

Mode of delivery

A 84(86.60%) of the patients were delivered in the hospital.

Type of delivery

The 71(73.19%) patients were born by vaginal delivery. 22(22.68%) patients were caesarean section. In the present study 6(6.19%) patients were breech delivery. 4(4.12%) were assisted vaginal delivery.

Types of cerebral palsy

In present study, spastic cerebral palsy (87.62%) was most common followed by hypotonic cerebral palsy (8.24%). Dyskinetic cerebral palsy was observed in 4.12% patient. The type of cerebral palsy is shown in Table 1.

Table 1: Types of cerebral palsy.

Types of cerebral palsy	Present study
Spastic	85(87.62%)
Hypotonic	8(8.24%)
Dyskinetic	4(4.12%)
Ataxic	0%
Mixed	0%

Topographical distribution of spastic cerebral palsy is shown in table 2.

In present study, quadriplegic cerebral palsy (52.57%) was the major type of cerebral palsy observed followed by diplegic type (27.84%). Hemiplegic was observed in 5.15% and double hemiplegia and paraplegia was observed in 1.03% patients.

Etiological factors

Etiology of CP were divided into antenatal, natal, postnat factors. Antenatal factors showed in table 3. In present study, pregnancy induced hypertension 14(14.43%) was most common antenatal factors involved followed by ante partum hemorrhage 8 patients (8.24%) was involved factor.

However, in a few cases, more than one probable cause was taken into account, as it was difficult to pinpoint one etiological agent.

Most common perinatal etiology and risk factors were present in patients of cerebral palsy and shown in table 4. In present study, most common perinatal factor was Low birth weight 37 patients (38.14%) followed by prematurity 23 patients (23.71%).

Table 2: Topographical distribution of spastic cerebral palsy.

Types of cerebral palsy	Number of patients	%
Quadriplegic	51	52.57%
Diplegic	27	27.84%
Hemiplegic	5	5.15%
Double hemiplegia	1	1.03%
Paraplegia	1	1.03%
Tetraplegia	0	0%
Monoparesis	0	0%

Table 3: Antenatal factors.

Antenatal factors	Number of patients	Observation
Pregnancy induced hypertension and eclampsi	14	14.43%
Ante partum hemorrhage	8	8.24%
Other infection (including chorioamnonitis)	4	4.12%
Maternal age <20 yrs. and >35 yrs.	8	8.25%
Multiple pregnancies	1	1.03%
ToRCH infection	1	1.03%
Gestational diabetes mellitus	1	1.03%
Polyhydromnios	2	2.06%
Malformation	1	1.03%
Consanguinity	1	1.03%

Table 4: Perinatal factors and cerebral palsy.

Perinatal risk factors	Number of patients	%
Low birth weight	37	38.14%
Prematurity	23	23.71%
Birth asphyxia	22	22.68%
Prolonged rupture of membrane	2	2.06%
Prolonged labour	3	3.1%
Intracranial hemorrhage	3	3.1%
Forceps delivery	3	3.1%
Breech	5	5.15%

Most common postnatal factors were Central nervous system infection 17(17.52%) followed by Septicemia 14(14.43%). Postnatal factors are shown in table 5. Types of cerebral palsy in relation to antenatal, perinatal, postnatal factors shown table 6-8.

Table 5: Postnatal factors and cerebral palsy.

Postnatal factors	Number of patients	Percentage
Septicemia	14	14.43%
Central nervous system infection (pyogenic meningitis, tuberculous meningoencephalitis, viral encephalitis)	17	17.52%
Hypoglycemia	5	5.15%
Convulsion	6	6.18%
Hyperbilirubinemia (kernicterus)	3	3.1%
Cerebrovascular accidents (stroke)	1	1.03%
Post-operative cardiac arrest	1	1.03%

Out of 51 patients of spastic quadriplegic cerebral palsy, Low birth weight constituted the majority (19 patients) in present study followed by 11 patients had birth asphyxia. 11 patients had Central nervous system infection.

Out of 27 patients of spastic diplegic cerebral palsy, Low birth weight constituted the majority (12 patients) in present study and 11 patients had prematurity followed by 7 patients had Birth asphyxia.

Out of 5 patients of hemiplegic cerebral palsy 2 patients had antenatal Pregnancy induced hypertension and eclampsia. 2 patients had prematurity.

Out of 8 patients of hypotonic cerebral palsy. most common factor was low birth weight (2 patients). Out of 4 patients of dyskinetic cerebral palsy, most common factor was Hyperbilirubinemia (kernicterus) (3patients), followed by Birth asphyxia (2 patients).

DISCUSSION

The incidence of CP in the indoor patient department was 0.78 per 100 patients.

In Asher and schonell's study, the incidence in bermingham was 0.9 per 1000 while in British birth survey it was 2.5/1000 live births.[4,5]

Table 6: Types of cerebral palsy in relation to prenatal factors.[9-13]

Etiological factors	Quadriplegic CP	Diplegic CP	Hemiplegic CP	Double hemiplegic CP	Paraplegic CP	Hypotonic CP	Dyskinetic CP
PIH	7	3	2	1	0	1	0
Ante partum hemorrhage	2	3	0	1	0	1	1
Chorioamnionitis	2	2	0	0	0	0	0
Maternal age<20 yrs and >35 yrs	3	4	0	0	0	1	0
Multiple pregnancies	1	0	0	0	0	0	0
ToRCH infection	1	0	0	0	0	0	0
diabetes mellitus	0	1	0	0	0	0	0
Polyhydromnios	2	0	0	0	0	0	0
Malformation	0	0	1	0	0	0	0
Consanguinity	0	0	1	0	0	0	0

Table 7: Types of cerebral palsy in relation to perinatal factors.

Etiological factors	Quadriplegic CP	Diplegic CP	Hemiplegic CP	Double hemiplegic CP	Paraplegic CP	Hypotonic CP	Dyskinetic CP
Low birth weight	19	12	1	1	1	2	1
Prematurity	9	11	2	1	0	0	0
Birth asphyxia	11	7	1	0	1	0	2
Prolonged rupture of membrane	2	0	0	0	0	0	0
Prolonged labour	1	1	1	0	0	0	0
Intracranial hemorrhage	2	0	1	0	0	0	0
Forceps delivery	0	2	0	0	1	0	0
Breech	1	3	0	0	0	1	0

Table 8: Types of cerebral palsy in relation to postnatal factors.

Etiological factors	Quadriplegic CP	Diplegic CP	Hemiplegic CP	Double hemi· plegic CP	Paraplegic CP	Hypotonic CP	Dyskinetic CP
Septicemia	8	4	0	0	1	1	0
Central nervous system infection	11	4	1	0	0	1	0
Hypoglycemia	2	3	0	0	0	0	0
Convulsion	2	2	1	0	0	1	0
Hyperbilirubinemia (kernicterus)	0	0	0	0	0	0	3
Cerebrovascular accidents	0	0	1	0	0	0	0
Post-operative cardiac arrest	0	0	0	1	0	0	0

In the present study, male to female ratio is 1.48:1. The male: female ratio varied from 1.2:1 to 3.16:1 in various studies.[6-9]

Most common age of presentation to the hospital was between 1-3 years. 59(60.82%) of the patients of age group 1-3 years came for specific treatment to this hospital.

There were 88.66% patients were 1st to 3rd born while 11.34% patients were of birth order of 4 and above with predominance of 2nd born (42.27%). While in Asher's study 1st born predominated with 56.4% patients.[4]

Here, 84(86.60%) of the patients were delivered in the hospital. Initially thought that home delivered child having birth asphyxia component and having cerebral palsy. But most (86.60%) patients hospital delivered so it denotes that other than birth asphyxia multiple factors involved in causation of cerebral palsy. 71(73.19%) patients were born by vaginal delivery. 22(22.68%) patients were caesarean section. In the present study 6(6.19%) patients were breech delivery. 4(4.12%) were assisted vaginal delivery. While in Asher's study 61% had normal delivery,4.1% breech delivered and 0.9% caesarean section.[4] CP was seen in 73.19% of vaginal deliveries which might be due to lack of timely intervention in the perinatal period and non-availability of appropriate obstetric and postnatal care.

Majority of cases had perinatal etiology and risk factors.in present study most common natal factor was Low birth weight 37 patients (38.14%) followed by prematurity 23 patients (23.71%).

In Srivastava study, Birth asphyxia (24.5%) was most common perinatal etiology followed by Prematurity (4.0%). In Nabanita Das study, birth asphyxia (57%) was most common factor followed by low birth weight (36%). In Gowda study, birth asphyxia (43%) was most common natal factor followed by low birth weight (30%).[6-8] One patient had also the multiple etiology for example low birth weight, prematurity and eclampsia were found in one patient.

In present study, pregnancy induced hypertension 14(14.43%) was most common antenatal factors involved followed by ante partum hemorrhage and Maternal age <20 yrs. and >35 yrs. 8 patients (8.24%) was involved factor. However, in a few cases, more than one probable cause was taken into account, as it was difficult to pinpoint one etiological agent. Fraser reported an increased risk of pre term birth, low birth weight and small for gestational age in teenage mothers in the age group of 13-17 years when compared to mothers of age group of 20-24 years.[10] Wu et al, (2006) and Thorngren-Jerneck et al, (2006) reported that maternal age over 35 years doubled the risk of Cerebral Palsy So Pregnancy induced hypertension and Ante partum hemorrhage leads to fetal hypoxia and leads to cerebral palsy.[11,12] In srivastava study toxemia (1.3%) and microcephaly (1.8%) were the most common etiological factors. In Nabanita Das study Maternal age <20 yrs and >35 yrs. (17%) and pregnancy induced hypertension (7%) were most common. In Gowda study, genetic malformation (16%) and Maternal age <20 yrs and >35 yrs (7%) were most common.[6-8]

Most common post-natal factor was Central nervous system infection 17(17.52%) followed by Septicemia 14(14.43%). In srivastava study, Central nervous system infection (17.1%) was most common factor followed by neonatal convulsion (3.7%). In Nabanita Das study, neonatal hyperbilirubinemia (14%) was most common factor followed by Central nervous system infection (8%). In Gowda study, encephalopathy (44%) was most common factor followed by Central nervous system (10%) and convulsion (10%).[6-8]

In present study, spastic cerebral palsy (87.62%) was most common followed by hypotonic cerebral palsy (8.24%). Dyskinetic cerebral palsy was observed in

4.12% patient. Ataxic and mixed variety of cerebral palsy was not observed in present study. It concludes that spastic type of cerebral palsy usually comes early for diagnosis because pyramidal system starts maturing as the age passes and increased tone is noticed by the parents earliest at 6-8 months which makes them attend medical practitioners early. This variety also has gross delay in mental physical development. In Srivastava study, spastic cerebral palsy (87.62%) was most common followed by hypotonic cerebral palsy. In Nabanita Das study, Spastic Cerebral Palsy (80%) was the largest group followed by mixed C.P. (8%) in this study. In gowda study, Eighty-one percent of the cases constituted a spastic variety of cerebral palsy followed by hypotonic cerebral palsy (12%) was observed.[6-8]

Topographically, quadriplegic cerebral palsy (52.57%) was the major type of cerebral palsy observed followed by diplegic type (27.84%). In Srivastava study, most common quadriplegic cerebral palsy was observed in 34.9% patients. Followed by hemiplegic cerebral palsy was observed in 28.7% patients. Diplegic cerebral palsy observed in 21.9% patients.

In Nabanita Das study, quadriplegic cerebral palsy (43%) was the major type of cerebral palsy observed followed by hemiplegic type (22%). diplegic cerebral palsy was observed in 12% and double hemiplegia was observed in 2% and tetraplegia was observed in 1% patients. In Gowda study, quadriplegic cerebral palsy (58%) was the major type of cerebral palsy observed followed by diplegic type (13%). hemiplegic was observed in 9% and monoparesis was observed in 1% patients.[6-8]

Out of 51 patients of spastic quadriplegic CP, most common factor was Low birth weight involved 19 (19.59%) patients followed by birth asphyxia 11(11.34%) patients and central nervous system infections 11(11.34%) patients. Out of 27 patients of spastic diplegic CP, most common factor was Low birth weight 12(12.37%) patients followed by prematurity 11(11.34%) patients. Most common cause for dyskinetic CP was Hyperbilirubinemia (kernicterus).

In present study, in distribution of etiological factors it was seen that perinatal risk factors including low birth weight (38.14%%, n=37) and prematurity (23.71%%, n=23) and asphyxia (22.68%%, n=22), were significantly more common in this current study. In srivastava study , anoxia(24.5%), encephalitis (12%), meningitis (5.2%) were common etiology.[6] In nanbita das study it was seen that perinatal risk factors including asphyxia (52.3%, n=68), low birth weight (41.5%, n=54) and prematurity (35.4%, n=46) were significantly more common.[7] In gowda study, birth asphyxia (43%), low birth weight (30%) and genetic malformation (16%) were more common etiologies.[8] In other studies conducted in Turkey; Erkin et al, determined the low-birth weight (45.1%), prematurity (40.5%) and asphyxia (34.6%); Öneş et al, determined the low birth weight (41.59%), anoxia (41.59%) and prematurity (35.40%), and Demir et al, determined the asphyxia (39.2%) and prematurity (25.5%) as the most common risk factors.[13-15] It was observed that the foremost risk factors were the perinatal risk factors in India. Authors assume that CP incidence can effectively be lowered by improving the pregnancy monitoring and by increasing the standarts of delivery rooms, delivery teams and neonatal intensive care units.

When the distribution of etiological factors in clinical classification is assessed, it is remarkable that low birth weight and asphyxia are more common in spastic quadriparesic CP, prematurity and low birth weight in spastic diplejic CP and neonatal hyperbilirubinemia in dyskinetic CP.

Major symptoms for which they admitted in the hospital was convulsion 53(54.63%).

CONCLUSION

Majority of cases had perinatal factors as etiology we can prevent CP by providing primary prevention, specific prevention and improving antenatal and intra-natal care. Disease progression of cerebral palsy can be halted by secondary prevention.

Complications can be prevented by and maximization of function can be done by tertiary prevention.

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