Risk factors and types of cerebral palsy

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Abstract

Objective: To determine the risk factors and associated types of cerebral palsy in a squatter settlement of Karachi.
Methods: The pilot cross-sectional study was conducted in Karachi during 2010 and 2011. Data was collected through an interviewed questionnaire from the mothers of cerebral palsy victims children from a population of 6000. Sample sizes of 20 pre-diagnosed victims were selected through snowball sampling. SPSS 20 was used for statistical significance.
Results: The mean age of the 20 children was 8.7±6.4 years. Of them, 16 (80%) were males and 4 (20%) were females. Major risk factors identified were; home and assisted delivery 5 (75%), consanguinity 10 (50%), infections 8 (40%) and lack of antenatal care 6 (30%). Out of 20 cases, 15 (75%) had spastic type of cerebral palsy, which was further classified as diplegia 7 (35%), quadriplegia 6 (30%) and hemiplegia 2 (10%). Mixed and dystonic types were found in 3 (15%) and 2 (10%) children respectively.
Conclusion: Important risk factors identified were home delivery, consanguinity and infections during pregnancy. Spastic type of cerebral palsy was the most common type in the study population.
Keywords: Cerebral palsy, Spastic cerebral palsy, Risk factor, Etiology, Home deliveries, Poor resource setting. (JPMA 64: 103; 2014).

Introduction

Cerebral palsy (CP) defines a group of disorders relating to "motor" development due to non-progressive lesions of the developing brain, often accompanied by disturbances of sensation, cognition and/or a seizure disorder.[1]

The overall prevalence is 2.5 per 1000 but may vary from 1 to 6 per 1000.[2,3] About 2 to 3 out of every 1,000 children have CP, making it the most common neuro-developmental motor disability in children.[4] Each year in the United States, approximately 1 in 278 infants is diagnosed with CP.[5] A similar study conducted in Faisalabad, Pakistan, regarding incidence of CP showed that out of a sample of 160 cases with abnormalities of tone, posture and movement, 75% (n=120) were diagnosed as having CP.[6]

While CP was initially attributed to injuries resulting from birth asphyxia, recent studies have shown that in actuality it includes a myriad of factors. Injury to the developing brain may be prenatal, natal or postnatal. Risk factors now known to play a role in the development of CP include multiple gestation, gender, infection, prematurity and low birth weight as well as genetic determinants.[7]

CP can be classified on the basis of type and severity of the motor abnormality along with the anatomical distribution. Using the afore-mentioned parametres the most commonly used classification divides individual cases into spastic (may be diplegic, hemiplegic or quadriplegic), dyskinetic (choreoathetoid or dystonic), ataxic or mixed types of CP.

After thorough literature search, it was found that information regarding frequency, types and etiology of CP is very scarce in our country. Gulshan-e-Sikanderabad is an under privileged squatter settlement in Karachi. During clinical postings in public healthcare (PHC) centre in this community it was noticed

that there were number of CP children who visited the centre for the purpose of rehabilitation. Therefore, the objective for conducting this study was to investigate the major etiologic factors behind the development of this disease and to determine the specific types of CP dominant in Gulshan-e-Sikanderabad.

Patients and Methods

The cross-sectional study was conducted from 2010 to 2011 in Gulshan-e-Sikanderbad, a poor-resource settlement in the heart of Karachi. The community has a total population of 35,000 and is divided into five blocks. This is a pilot study which mainly focused on Block 4, which had a population size of 6,000. A sample size of 20 children with CP were included in the study.

To identify the CP children within the community, snowball sampling technique[8] was adopted due to the lack of or incomplete data within the local authorities. It is a non-probability form of sampling and works by first identifying a single family with an affected child and then inquiring from them if they know another family with a similarly disabled child and so on. The success of this sampling technique stemmed from the fact that it is a small and closely-knit community.

Children (age 1 week to 14 years) previously diagnosed, and whose parents gave an informed consent were included in the study. Adults suffering from CP and parents who refused to give consent were not included. Risk factors analysed were defined as any factor during the prenatal, natal and postnatal developmental period of the child which increased the possibility of CP.

A detailed history was taken from the mother or the guardians of the children with the help of a pre-structured proforma followed by a detailed general, developmental and neurological examination. The children were classified according to the Swedish Classification into spastic, ataxic, dyskinetic and mixed forms.[2] The etiological classification used was: i) congenital (prenatal, perinatal and premature) causes; and ii) acquired (CP occurring in a child with a normal birth history and due to recognisable factors during development) causes.

Data was entered and analysed using SPSS version 20. All qualitative variables were presented as frequencies and percentages, while all quantitative variables were presented as mean and standard deviation. Due to small sample size, non-parametric f-test of significance was applied to find association between frequencies and risk factors and p-value <0.05 was considered significant.

Results

Overall, there were 16 (80%) males and 4 (20%) females, with a male-to-female ratio of 4:1. Mean age of children was 8.67±6.44 years and mean age at the time of diagnosis of CP was 0.7±1.1 years. Positive family history of CP was found in 4 (20%) cases. During pregnancy with the CP child, 14 (70%) mothers had received antenatal care, but only 5 (25%) children were born in hospitals/maternity centres while the remainder were born either at home or delivered by Dais (Traditional Birth Attendants) (Table-1).

Table-1: Birth history of cerebral palsy children.

	Frequency (n=20)	Percentage (%)
Avail Antenatal Care	14	70
Place of Delivery		
Dai	8	40
Home	7	35
Hospital	5	25
Mode of Delivery		
Normal Vaginal	19	95
LSCS	1	5
Term of Pregnancy		
Term	16	80
Preterm	3	15
Post term	1	5
Birth Weight		
Normal	12	60
Low Birth Weight	5	25
Above Normal	3	15
Risk Factors of Cerebral Palsy		
Risk Factors		
Prenatal		
Consanguinity	10	50
Lack of Antenatal Care	6	30
Infections	2	10
Multiple Births	1	5
Malnutrition	1	5
Trauma during Pregnancy	1	5
Natal and Post-Natal		
Home and Dai Assisted Deliveries	15	75
Neonatal Seizures	10	50
Infection during Pregnancy	8	40
Kernicterus	6	30
Birth Asphyxia	5	25
Low Birth Weight	2	10

LSCS: Lower segment caesarean section.

Regarding immunisation status, 18 (90%) had received vaccines, but only 13 (65%) had complete immunisation while 5 (25%) had incomplete immunisation status.

The most common type of CP seen was the spastic type in 15 (75%) children, while the remaining 2

(10%) cases were dystonic type and 3 (15%) were mixed variety. The breakup of spastic type was quadriplegic 6(30%), diplegic 7 (35%) and hemiplegic 2 (10%).
Mothers of these children were interviewed and risk factors were classified into prenatal, natal and postnatal risk factors. Among them home and Dai-assisted deliveries 15 (75%), consanguinity 10 (50%), neonatal seizures 10 (50%), infection during pregnancy 8 (40%) and lack of antenatal care 6 (30%) were found to be the most common risk factors.
The relationship of risk factors with the specific type of CP was also studied. Spastic quadriplegia and diplegia were caused mainly by a lack of antenatal care 3 (30%) and home and Dai-assisted deliveries 6 (35%) respectively. Multiple risk factors were found in the hemiplegic cases. Among those suffering from mixed type of CP, consanguinity was found as the main risk factor 3 (15%). Neonatal seizures 2 (10%) and low birth weight 2 (10%) were the dominant risk factors among those with dystonic CP (Table-2).

Table-2: Relationship of Type and Risk Factors of Cerebral Palsy (N = 20).

Risk Factors	Spastic Quadriplegia n=6 (%)	Spastic Diplegia n=7 (%)	Hemiplegia n=2 (%)	Mixed n=3 (%)	Dystonic n=2(%)	P-value	
Prenatal							
Consanguinity	3 (15)	2 (10)	1 (5)	3 (15)	1 (5)	0.369	
Lack of Antenatal Care	6 (30)	3(15)	2 (10)	2 (10)	1 (5)	0.179	
Infections	1 (5)	1 (5)	-	-	-	0.875	
Multiple Births	-	-	-	1(5)	-	0.202	
Malnutrition	-	-	-	-	1 (5)	0.05	
Trauma during Pregnancy	1 (5)	-	-	-	-	0.635	
Natal and Post-natal							
Home and Dai Assisted Deliveries		3 (15)	7 (35)	2 (10)	2 (10)	1 (5)	0.216
Neonatal Seizures	1 (5)	3 (15)	2 (10)	2 (10)	2 (10)	0.129	
Infection during Pregnancy	3 (15)	3 (15)	-	1 (5)	1 (5)	0.782	
Kernicterus	2 (10)	2 (0)	1 (5)	-	1 (5)	0.72	
Birth Asphyxia	1 (5)	-	2 (10)	1 (5)	1 (5)	0.05	
Low Birth Weight	2 (10)	6 (30)	2 (10)	2 (10)	2 (10)	0.331	

Mothers of CP children were inquired about any health facility in their area of residence and almost all of them were aware about the presence of a health centre. However, only 16 (80%) mothers had previously availed of that facility for their CP child.
Different modalities of treatment were undertaken by the CP children at some point, including physiotherapy 12(60%), vocational and educational training 4(20%), while 4 (20%) families availed no treatment facilities. Out of all children who underwent physiotherapy, 4 (20%) had a better outcome, whereas 7 (35%) with no history of physiotherapy were either dependent for mobility or required a wheelchair.
Eleven (55%) families planned a future (vocational and educational training) for their CP child. Among the remaining 9 (45%), 5 (25%) stated that they were unaware about how to proceed and 4 (20%) cited financial issues as the primary obstacle.
Nine (45%) families are now aware of precautions that would help in preventing further CP cases in their family. Out of them, 4 (20%) plan to seek antenatal care in future pregnancies, 4 (20%) prefer hospital deliveries whereas 1 (5%) said it would discourage family marriages.

Discussion

CP is the commonest physical disability in childhood yet in many cases the cause remains unknown.[7]

Very little work has been done in our setting regarding the prevalence or etiology of CP. The study aimed at highlighting some of the major risk factors associated with CP, which is an essential first step in reducing the burden of this disease in our country.

Efforts linking CP to specific etiological factors have been attempted worldwide.[6,7,9,10] Risk factors identified in this study are similar to the ones reported by others. In about a quarter of the children examined, the prenatal causes were maternal trauma, malnutrition, infection during pregnancy and multiple births.[11-16] Among all these factors, the presence of infection or fever during pregnancy was more prominent in this poor-resource community.

About half-a-century back, Eastman and DeLeon reported an interesting and similar association between infection in women during labour and an increased rate of delivering babies suffering from CP[17] Over the years, various other studies have also found such associations, especially the data collected by the National Institutes of Health Collaborative Perinatal Project (NCPP) which revealed that moderate to severe inflammatory infiltrates present within the placenta increase the risk of developing CP in both preterm and term infants.[18]

Significant association between low birth weight and CP has been seen in various Western studies.[19] This is mainly because of the increased survival of preterm and low birth weight babies due to the availability of advanced obstetric care, which indirectly increases the risk of CP in these infants. However, unlike Western figures, most CP children examined in this particular study were born at term. Lack of antenatal care puts the mother and her unborn child at an increased risk of prenatal, natal and postnatal complications during pregnancy thereby increasing the risk of CP in the unborn child.[20] However, in this study the majority of mothers, nearly three-fourths, despite having acquired antenatal care, delivered at home. Delivery in a non-hospital setting places the infant at a risk of some of the suspected associations of CP such as birth asphyxia.

The role of birth asphyxia in the causation of CP has been greatly discussed and challenged throughout literature; Western studies show that there is no significant association, while the developing countries especially North India, Nigeria and Malta found a strongly suggestive history of birth asphyxia in the affected children.[9] Observations supporting asphyxia as a contributory factor were seen in this poor resource community as well.

Acquired causes of CP, for instance kernicterus, meningoencephalitis and neonatal seizures, greatly contributed to a significant portion of CP in this community. Rates of post-natal infections are higher in poor-resource settings as compared to industrial countries, a point that must be borne in mind when developing future preventive strategies.[13,21] Neonatal seizures however, continue to be a strong cause of CP not only in this setting, but also throughout the world.[22]

Regarding the type of CP, spastic CP is more common (70 to 80 per cent) as compared to the other forms.[23] However, there are discrepancies between the developed and developing countries when it comes to identifying the commonest subtype of spastic CP. The quadriplaegic CP rates have been reported to be much higher in poor-resource countries as compared to the developed countries.[22] The proposed reason for this decrease in quadriplaegic type of CP in developed countries is due to the increased survival of extremely premature infants.[22] Similar observations were made in this study as well where the spastic form of the disease was predominant, but was equally spread between spastic quadriplaegic and diplaegic types.

Consanguineous marriage and lack of antenatal care were important community-related risk factors identified. Consanguinity is a common practice in this part of the world due to an intricate and close family system. Its relation with CP, although not clear, has been cited in European countries.[24]

Majority of the families interviewed, when asked about their CP child's future, showed concerns and wanted him/her to have a normal life. More than half of these families had utilised various treatment modalities in the past like physiotherapy and vocational/educational training, but abandoned them

when their children did not show any immediate improvement. In the study, the Gross motor functional classification system was used to assess the impact, if any, that such therapies may have had on the quality of life of the patient. Out of the 12 children who underwent physiotherapy, 4 had a better outcome whereas a staggering 7 of the 8 with no history of physiotherapy were either dependent for mobility or required a wheelchair. This information and data from other related studies suggests that physical therapy has advantageous long-term effects in improving the quality of life of a CP sufferer.[25] When these families were asked about what precautions they were undertaking to prevent further CP cases in the family, the consensus was on seeking proper antenatal care and conducting deliveries in a hospital. This showed that prior experience of raising a CP child and counselling in the society by healthcare providers helped increase awareness among the affected families, which could help reduce further incidences of CP in the community.

There were several limitations to our study. Firstly, the study only included a single block of the community and not the whole community. Secondly, due to the nature of the research (pilot study), lack of funds and manpower, a door-to-door survey was not conducted, which could have helped us identify further cases. Thirdly, the small sample size makes it difficult for us to accurately derive any true associations between the observed risk factors and CP.

Despite the limitations, it paves way for further studies that need to be conducted in this population on a larger scale to better assess and understand the various contributory components leading to the development of CP. That will facilitate the process of developing effective preventive strategies aimed not only at the causative factors prevalent in this particular community, but that can then be also applied to the country as a whole.

Conclusion

In line with previous studies, spastic type of CP was proven to be the dominant form of the disease. Lack of proper antenatal care and delivery in a non-hospital setting appeared to be the major factors contributing towards the development of CP. Enhancing parents' knowledge about their child's condition as well as targeting the preventable causes could be crucial in modifying the rising trend of childhood disability. A major stumbling block for not continuing therapy turned out to be a lack of treatment facilities available, suggesting the dire need for setting up specific centres dedicated solely towards the management of this debilitating disease.

Acknowledgement

We are grateful to the staff and doctors of the primary healthcare center in Gulshan-e-Sikanderabad for assisting us during the data collection, and to the families of all the children we interviewed. A special thanks to Mrs. Shehla for helping us throughout the data collection process, and to Dr. Farah of the Community Health Sciences Department, for her inspirational words.

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