Profile of cerebral palsy in a rehabilitation hospital in Brazil

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ABSTRACT

Objective. To describe the clinical-epidemiological profile of cerebral palsy in 201 individuals who were admitted to a rehabilitation hospital in Brazil between 2001 and 2007.


Results. We evaluated 201 children with cerebral palsy, of whom 116 were males. The mean age was 5 years and 5 months. It was found that 26% of mothers had not undergone prenatal monitoring. Its absence has been found to impact the prevalence of spastic cerebral palsy. Bleeding and loss of amniotic fluid were the most frequent antenatal risk factors, and the use of misoprostol was reported by a significant number of mothers. Neonatal events occurred in 63.5%. Thirty percent of them suffered from delivery room resuscitation, 64% had respiratory disorders, and 52% presented jaundice. There was a significant relationship between anoxia and spastic cerebral palsy as well as between jaundice and dyskinetic cerebral palsy. The most common type of cerebral palsy was spastic, and Gross Motor Function classification system level V was predominant. Cognitive delay occurred in 70%, and epilepsy in 42%. School was attended by 44% of the patients.

Conclusion. The etiology of cerebral palsy is multifactorial, and its characteristics in this population show peculiarities that are of paramount importance in the development of strategies for prevention and rehabilitation.

Key words. Cerebral palsy; classification; epidemiology; etiology; epilepsy.

RESUMO

Perfil da paralisia cerebral em um hospital de reabilitação no Brasil


Método. Estudo de corte transversal com descrição de dados coletados em prontuários eletrônicos de pacientes.

Resultados. A média de idade foi 5 anos e 5 meses. Dos fatores de risco gestacionais, verificou-se que 26% das mães não realizaram o acompanhamento pré-natal, e a sua ausência mostrou ter relação com o tipo espástico de paralisia cerebral. A hemorragia e a perdida de líquido amniótico foram as intercorrências gestacionais mais frequentes, e o
uso do misoprostol foi admitido por um número relevante de mães. Os fatores pré-natais ocorreram em 63,5%, com necessidade de reanimação em sala de parto em 30% dos casos, distúrbio respiratório precoce em 64% e icterícia em 52%. Observou-se relação significativa da anóxia com a paralisia cerebral espástica e da icterícia com a paralisia cerebral discinética. A classificação da paralisia cerebral mais encontrada foi a espástica. A classificação da Função Motora Grossa mostrou predominância do nível V. O re-tardo mental ocorreu em 70% e epilepsia em 42% dos indivíduos. Inserção escolar foi descrita em 44% da amostra.

Conclusão. A causa da paralisia cerebral é multifatorial, e as características desse distúrbio em cada população evidenciam peculiaridades que são de grande importância para desenvolver estratégias regionais de prevenção e reabilitação.

Palavras-chave. Paralisia cerebral; classificação; epidemiologia; etiologia; epilepsia.

INTRODUCTION

Cerebral palsy describes a group of permanent disorders involving the development of movement and posture that are attributed to non-progressive disturbances affecting the developing fetal or infant brain. It is often accompanied by disturbances of sensation, cognition, communication, perception, and behavior, as well as by epilepsy.

Despite the diverse focus of studies in this field, there is still much to be learned about the clinical and epidemiological factors of this disease, especially in developing countries.

Current data on the prevalence of cerebral palsy in Brazil is unknown. Its instances are estimated to be high due to the poor health care provided to pregnant women and newborns in many regions. It has been reported that there are about 17,000 new cases of cerebral palsy each year in Brazil.

The main objectives of this study are to determine the clinical and epidemiological profile of cerebral palsy and its main risk factors in individuals admitted to a rehabilitation hospital in Bahia, Brazil.

METHODS

Participants

Between March 2001 and March 2007, individuals at different ages with a diagnosis of cerebral palsy were selected for the above-mentioned study. All of these individuals had been admitted to the Pediatric Rehabilitation Center of the Sarah Hospital in Salvador, Bahia, Brazil.

The inclusion criteria consisted of children of both genders, from 2 to 16 years old, originally from the state of Bahia, diagnosed with cerebral palsy and whose complete data were available in electronic medical records. The exclusion criteria were patients with other associated diagnoses, like myelomeningocele and genetic syndrome.

This research study was approved by the Medical Ethics Commission of the Sarah Network of Rehabilitation Hospitals, Brazil. Informed consent was not necessary because the data were available in electronic medical records.

Procedures

The protocol for collecting data included the examination of variables such as maternal prenatal care, neonatal information, and postnatal factors. Additionally, we examined the cerebral palsy classification, motor impairment, and associated disorders of each individual.

The maternal information that was examined included mother’s age, achieved level of education, number of pregnancies, any previous abortions, and a laboratory diagnosis of congenital infections and complications, such as fever, bleeding, drug use, smoking, alcoholism, attempted abortion, loss of fluids, diabetes, hypertension, rash, anemia, urinary tract infection, and genital infection. We also looked at consanguinity between parents, twin pregnancies and birth order, level of prenatal care, and pregnancy ultrasounds.

The neonatal variables examined included delivery type (vaginal birth with or without forceps or caesarean section), gestational age, birth weight,
Apgar score at both one and five minutes after birth, newborn complications (respiratory disorders, metabolic disorders, infections, jaundice, convulsions, etc), length of hospital stay, and laboratory diagnosis of congenital infections.

Cerebral palsy is classified, based on the predominant type of motor impairment, as spastic, dyskinetic, ataxic, hypotonic or mixed. The associated disorders studied were epilepsy (defined as the presence or absence of seizures and the use of antiepileptic drugs) and cognitive delay, measured based on variations in the expected cognitive development for their age group in accordance with Piaget’s theories.

Other data evaluated included school attendance (at traditional schools, special schools or neither), daily life (degree of independence, in accordance with the child’s age), and neuroimages of computerized tomography and magnetic resonance imaging scans.

Statistical analysis

Information was stored on an ACCESS database and statistically analyzed using SPSS 13.0. The descriptive statistics used were frequency distribution, central tendency, and dispersion. To compare quantitative variables, the non-parametric Mann-Whitney and Kruskal Wallis tests were implemented; categorical frequency data were analyzed using Yates’ chi-square test. Fisher’s exact test was used to compare proportions between groups. Differences were significant at a level of 5%.

RESULTS

As a whole, 201 children were selected for the study, and 116 of them were males. Of these patients, 27% were from Salvador, the capital of the state of Bahia, and the remainder was from other places within the state. The mean age at the time of hospital admission was 5 years and 5 months (SD 3.38).

Regarding the mother’s level of education, 31% had completed the first stage of basic education, 12% the second stage, 22% high school, and 3% were not literate. One of the mothers had completed higher education, and the educational information of 29% of the subjects’ mothers was not available in their medical records.

Maternal age during pregnancy was measured in intervals; the mode of maternal age group was 15 – 20 years old. Inbreeding of parents was reported in 5% of cases. There was family history of cerebral palsy in 8%, mental retardation in 14%, and epilepsy in 12%. Previous abortions were reported by 30% of mothers, 75% of which were spontaneous. Prenatal care was undergone by 74% of mothers, and tests for congenital infections were positive in 27% of cases. Among the mothers tested during this research study, one had a diagnosis of toxoplasmosis, two of rubella, and three of syphilis. Of the mothers who underwent ultrasounds (68%), hydrocephalus was detected in 6.6%, oligohydramnios in 2%, intrauterine growth retardation in 3.5%, and placental abnormalities in 5.5%. Twin births occurred in 4% of pregnancies. Forty-one percent of the mothers studied had uneventful pregnancies. The remainder experienced risk factors, oftentimes several of them during the same pregnancy. Bleeding was the most frequent complication, occurring in 20.6% of pregnant women with complications (Table 1).

<table>
<thead>
<tr>
<th>RISK FACTORS</th>
<th>FREQUENCY</th>
<th>%</th>
</tr>
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<tbody>
<tr>
<td>Bleeding</td>
<td>32</td>
<td>20.6</td>
</tr>
<tr>
<td>Amniotic fluid loss</td>
<td>21</td>
<td>13.5</td>
</tr>
<tr>
<td>Hypertension</td>
<td>18</td>
<td>11.6</td>
</tr>
<tr>
<td>Preeclampsia</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Eclampsia</td>
<td>5</td>
<td>3.2</td>
</tr>
<tr>
<td>Anemia</td>
<td>10</td>
<td>6.5</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>6</td>
<td>3.9</td>
</tr>
<tr>
<td>Rash</td>
<td>6</td>
<td>3.9</td>
</tr>
<tr>
<td>Fever</td>
<td>5</td>
<td>3.2</td>
</tr>
<tr>
<td>Hyperemesis gravidarum</td>
<td>4</td>
<td>2.6</td>
</tr>
<tr>
<td>Genital infection</td>
<td>3</td>
<td>1.9</td>
</tr>
<tr>
<td>Gestational diabetes</td>
<td>1</td>
<td>0.6</td>
</tr>
<tr>
<td>Misoprostol use</td>
<td>21</td>
<td>13.5</td>
</tr>
<tr>
<td>Drug use</td>
<td>18</td>
<td>11.6</td>
</tr>
<tr>
<td>Smoking</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>Alcoholism</td>
<td>16</td>
<td>10.3</td>
</tr>
<tr>
<td>Abortive tea use</td>
<td>10</td>
<td>6.5</td>
</tr>
</tbody>
</table>
In 95% of cases, the children were born in a hospital: 75% by vaginal delivery and 25% by caesarian section. The mean gestational age was 36.5 weeks (SD 5.32), and 63% of patients were born at term, 35% preterm, 2% post-term. The mean birth weight was 2700 g (SD 0.9) (Table 2). Hypoxia related data were assessed through the Apgar index. Crying and persistent cyanosis at birth were present in 42% of subjects.

Postnatal risk factors were identified in only a small number of cases (7%): one case of traumatic brain injury; eight of meningoencephalitis; four of hypoxic-ischemic encephalopathy, as a result of an anesthetic accident; and one of congenital heart disease.

After the cerebral palsy cases were classified, the following statistics were found: 77% of the children were spastic, 17% were dyskinetic, 2% were ataxic, 3% were mixed, and there was only one case of hypotonic cerebral palsy. Of the children with spastic cerebral palsy, 23% were quadriplegic, 23% were hemiplegic, 20% were diplegic, 10% were triplegic, and 1% was monoplegic. There was a statistically significant association between antenatal care and the type of spastic cerebral palsy that the patients developed (p = 0.004). Completion of prenatal examinations positively correlated with instances of topography hemiplegia (p <0.01). There was a significant correlation between use of misoprostol and occurrence of spastic cerebral palsy (p <0.01). There was a statistically relevant association between prematurity, caesarian section and diplegia (p <0.05). Complications after birth were present in different types of cerebral palsy, but there was a higher than average correlation between presence of complications and dyskinetic cerebral palsy (p <0.01). Regarding neonatal complications, delivery room resuscitation was associated with occurrence of spastic cerebral palsy (p = 0.09), and jaundice was associated with occurrence of dyskinetic cerebral palsy (p <0.01). It was observed that 30% of subjects were severely impaired and acquired no motor acquisitions. Of these 60 patients, 41 had been diagnosed with spastic tetraplegia, one with spastic diplegia, one with spastic triplegia, two with spastic hemiplegia, 11 with dyskinetic, one with hypotonic, and three with mixed cerebral palsy. Out of the 46 patients with spastic hemiplegia, 33 were able to walk without assistance.
Some degree of cognitive delay was found in 70% of subjects, measured against expected cognitive development for their age group in accordance with Piaget’s theories. In 44% of cases, the patients attended school.

Epilepsy was present in 42% of the patients that had associated spastic cerebral palsy (p < 0.03). It was observed that tetraplegia was positively associated with epilepsy (p < 0.03) and cognitive delay (p < 0.01).

Regarding the degree of independence in daily activities, overall assessment showed that 44% fed independently, and 21% dressed themselves and took care of their own hygiene. Most individuals with spastic tetraplegia and dyskinetic cerebral palsy were totally dependent in daily activities, with significant differences (p < 0.01) in comparison to other groups. There is positive association between hemiplegia and independent feeding (p < 0.01).

Computerized tomography scans were performed on 121 patients, and magnetic resonance imaging scans were performed on 9. The results of both methods were grouped, and 83% of patients had abnormal scans. The most frequent abnormalities were cortical atrophy (29%) and leukomalacia (17%) (Table 4). The patients with spastic and dyskinetic cerebral palsy showed more irregularities (p < 0.02). Tetraplegia was correlated with cortical atrophy (p < 0.02).

Table 4. Findings from imaging tests of individuals selected among the cerebral palsy patients admitted to the Hospital Sarah-Salvador between March 2001 and March 2007

<table>
<thead>
<tr>
<th>NEUROIMAGING FINDINGS</th>
<th>FREQUENCY</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal images</td>
<td>22</td>
<td>17</td>
</tr>
<tr>
<td>Cortical atrophy</td>
<td>38</td>
<td>29</td>
</tr>
<tr>
<td>Periventricular leukomalacia</td>
<td>22</td>
<td>17</td>
</tr>
<tr>
<td>Hydrocephalus VPS*</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Hydrocephalus ex-vacuo</td>
<td>35</td>
<td>26.5</td>
</tr>
<tr>
<td>Schizencephaly</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>Calcifications</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>Asymmetric ventricles</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Abnormal neuronal migration</td>
<td>6</td>
<td>4.5</td>
</tr>
<tr>
<td>Vascular malformations</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>Porencephaly/encephalomalacia</td>
<td>6</td>
<td>4.5</td>
</tr>
<tr>
<td>Other malformations</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Others</td>
<td>6</td>
<td>4.5</td>
</tr>
</tbody>
</table>

* VPS – ventricular-peritoneal shunting.

It was observed that admission of children with cerebral palsy occurred late (the mean age was 5 years at admission), which often hinders efforts of rehabilitation. Delays in the detection of cerebral palsy by pediatricians and families and lack of medical attention could both explain this late admission.

The majority of the patients’ mothers had not completed an educational level beyond the first stage of basic education. This relates to the low socioeconomic status of the studied population, as it has been reported in several studies.

The observed maternal age was lower than that of an average study. The high occurrence of young mothers is a result of early sexual activity. Unwanted and unplanned pregnancies may leave these women with little guidance and an absence or delay in prenatal care or may lead them to attempt abortion.

Even though 74% of mothers reported that they had received prenatal care, the presence of congenital infections was detected in 27% of cases, and ultrasound examinations during pregnancy were done in 68%. These data highlight the poor quality of care that pregnant women in Brazil receive. We observed a higher prevalence of severe forms of cerebral palsy in pregnant women who lacked proper prenatal care. Many cases of cerebral palsy could be prevented through early detection of risk factors during pregnancy.

It was observed that a majority of the mothers experienced complications during pregnancy and experienced several antenatal risk factors for cerebral palsy. Other studies have described gestational hemorrhage, gestational hypertension, and gestational diabetes as common risk factors for cerebral palsy. Our study, however, showed gestational diabetes as a rare occurrence, maybe because most of the mothers were young adults. Also, poor prenatal care could have contributed to this deviation, if laboratory tests for detection of gestational diabetes were not carried out. Chorioamnionitis is another known risk factor, but it was absent in our
sample, perhaps also due to inadequate prenatal care and lack of family history.

Misoprostol is a drug that may trigger abortion. Though abortion is an illegal medical procedure in Brazil, the Ministry of Health reports that about 1,400,000 abortions occur each year, many with the aid of misoprostol. This drug is effective only when properly used. When there is improper self-medication, pregnancy is not terminated, and the fetus is exposed to drugs that may cause abnormalities, such as microcephaly, hydrocephaly, and cerebral palsy. The topic of abortion is a delicate issue, with emotional and legal implications. Considering that abortion is illegal in Brazil, it is possible that some mothers have used misoprostol and not reported it. Nevertheless, we found a clinically significant correlation between use of misoprostol and spastic cerebral palsy.

According to Murphy et al., the rate of caesarian deliveries increases in cases of high-risk delivery such as prematurity, twins or anoxic fetuses. It is possible that the rate of caesarian sections in this study is a result of the low quality of perinatal care, predisposing the newborns to the risk of prolonged labor and hypoxia. However, Scheller and Nelson state that caesarian deliveries do not reduce the risk of cerebral palsy.

In this study, the mean gestational age was under 37 weeks, and prematurity was associated with diplegic cerebral palsy. Current published literature describes an increase in the prevalence of cerebral palsy in relation to prematurity and low birth weight. Ancel et al. showed that 1 in every 12 preterm infants develops cerebral palsy. The more premature the infant is, the higher the risk is, with cerebral palsy occurring in 20% of infants born before 27 weeks of gestation, in 12% of infants born between 27 and 28 weeks, in 8% born between 29 and 30 weeks, in 7% born at 31 weeks, and in 4% born at 32 weeks. Stanley showed that cerebral palsy appears in 4% of the newborns weighing less than 2000 g.

Although the role of neonatal anoxia was considered very important in cerebral palsy in the past, many current studies question this, noting its association in 6% to 9% of etiologies. In this study, data on hypoxia are described indirectly, and it is possible that it is a consequence of brain immaturity in infants who had already had some kind of perinatal injury. The length of hospital stay was prolonged in a significant number of patients, suggesting neonatal complications in need of special treatment.

Current literature shows that brain damage caused by neonatal jaundice can be significantly reduced by early and appropriate treatment. In this study, however, jaundice was identified in 52% of subjects with neonatal risk factors and found to have a statistically significant correlation with dyskinetic cerebral palsy. It is possible that many children did not have access to appropriate treatment because of lack of resources in neonatal units.

The classification of cerebral palsy is still subject to discussion and study, due to lack of data uniformity. We try to minimize this problem at the Sarah Hospital by training professionals to use the same classifications. The spastic type was the most prevalent, followed by the dyskinetic and mixed types. This finding is consistent with the literature.

According to Krigger, two thirds of cerebral palsy patients have mental retardation, and half of them have epilepsy. In our study, similar frequencies were found; 70% had some degree of cognitive delay, and 42% had epilepsy. These disorders correlate with the motor limitations of cerebral palsy, further worsening the quality of life and social implications, as well as increasing expenditures related to treatment.

This study showed a statistically significant correlation between epilepsy and spastic cerebral palsy. Epilepsy was also found to be related to quadriplegia. Data from the Brazilian Cerebral Palsy Association showed presence of epilepsy in 27% of patients with dyskinetic cerebral palsy, 31% with diplegia, 67% with hemiplegia, and 56% with tetraplegia.

Almost half of the sample attended school. These statistics accurately show the respective severity of these patients’ cerebral palsy. A study conducted in Brazil showed the percentage of school integration among patients with cerebral palsy to be...
at around 56.5%. Similar work carried out in Spain by Bringas-Grande et al.\textsuperscript{7} showed a much higher percentage, with about 81.2% of the patients integrated. This disparity indicates that Brazil could implement more suitable educational possibilities for students with cerebral palsy.

Woodward et al.\textsuperscript{24} performed magnetic resonance imaging scans on patients at risk and found a statistically significant relationship between cerebral palsy and the following findings: change in tone and reduction of white matter, cystic abnormalities, dilatation of ventricles, delayed myelinization, thinning of callosum corpus, and cortical atrophy. Other authors also describe the correlation between cerebral palsy and cerebellar changes, hydrocephalus, hydranencephaly, lissencephaly, schizencephaly, and calcifications.\textsuperscript{25} This study evaluated the results of tests conducted in the hospital, and the results concurred. Cortical atrophy was often found, which is in line with data found in the literature.\textsuperscript{7} Brain scan was significantly more irregular among the patients with spastic cerebral palsy, who constituted the most severely compromised group.

We found some limitations to the study. The risk factors could not be measured in concrete terms because the clinical data were retrospectively obtained from families and results of laboratory tests and medical reports. It is a clinical-epidemiological study, so no control group was used and it was not possible to measure the temporal presence of etiological factors and cerebral palsy. Nevertheless, the main objective of describing the presence of risk factors and the characteristics of cerebral palsy in this given population was met.

There are few studies on the major risk factors for cerebral palsy in more socio-economically deprived populations. The data we used come from studies in developed countries, whose populations are more able to take effective measures for prevention and rehabilitation.

The risk factors for cerebral palsy are modifiable in many cases. Many of the complications during the prenatal and perinatal periods described in this paper could be avoided if medical care was introduced. There is a need to create programs for prevention, early detection, and treatment, as well as a need for the continuing education of the health professionals who deal with these patients. \textsuperscript{16}

REFERENCES