

Analysis of Risk Factors Related To Hip and Head Imaging Abnormality Rate in Children with Cerebral Palsy

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Abstract

Objectives: To investigate the relationship between the related risk factors of children with cerebral palsy in hip and brain and provide guidance for the implementation of early intervention.

Methods: We recruited 198 children with cerebral palsy aged 1-12 years old from five rehabilitation institutions in Anhui Province. Chi-square test was used to analyze the relationship between gender, birthplace, head imaging features, hip joint imaging features, limb disability types and dyskinesia types.

Results: The abnormal hip joint imaging rate of children born in township hospitals is slightly higher than that born in county-level hospitals (29.6%:27%), but no statistical difference was found ($\chi^2=0.132$, $P=0.717$). There was statistical difference between the different types of dyskinesia and hip joint imaging features ($\chi^2=8.136$, $P=0.043$). There was no statistical difference between the different types of limb disability and hip joint imaging features ($\chi^2=1.252$, $P=0.535$). There was no significant difference between different genders and hip joint imaging features ($\chi^2=0.502$, $P=0.479$). The head imaging abnormality rate of children born in township hospitals is slightly higher than that born in county-level hospitals (73.8%:68.6%), but no statistical difference was found ($\chi^2=0.537$, $P=0.464$). There was significant difference between head imaging features and dyskinesia types ($P=0.004$).

Conclusion: We need to be highly vigilant for the hip joint abnormality in children with dystonia and mixed type cerebral palsy. Early intervention guidance should be strengthened for children with cerebral palsy born in township level hospitals.

Keywords: Cerebral palsy; Hip joint; Head imaging; Place of birth

Introduction

Cerebral palsy describes a group of movement and posture disorders, causing activity limitations, which are attributed to non-progressive disturbances in a developing fetal or infant brain. Motor disorders of cerebral palsy are often associated with sensory, perception, cognitive, communication and behavioral disorders, as well as epilepsy and secondary muscle and bone problems [1-2]. The dysfunction mainly results from immature brain (prenatal, intrapartum or postnatal) congenital developmental defects (malformation, intrauterine infection) or acquired (preterm, low birth weight, asphyxia, hypoxic ischemic encephalopathy, jaundice, trauma, infection etc.) non-progressive brain injuries. The pathological changes of cerebral palsy are mainly leukodystrophy, abnormal brain development, intracranial hemorrhage, and brain damage caused by hypoxia, and the prevalence rate is about 2.0 to 3.5 per 1000 live births [3-6]. Abnormal limb muscle force, tension and movement patterns, often accompanied by abnormal hip, are found among children with cerebral palsy. Without a long-term rehabilitation treatment, secondary deformity of the hip joint would occur. Along with the age growth, the symptoms gradually become obvious, affecting the children's walking function in the future [1].

China has a large population base. Every year, a great number of newly-born children with cerebral palsy cause a heavy burden on the family and society. Due to the vast territory, uneven development in various regions and relatively backward medical and economic conditions in rural areas and towns of China, many children with cerebral palsy have not been diagnosed and treated at the early stage. Is there a higher rate of brain injury and hip joint abnormality in children born with cerebral palsy at the medical institutions in rural areas and towns? What are the factors associated with abnormal hip joint in children with cerebral palsy? What is the relationship between head imaging and the type of cerebral palsy? This study aims:

- To explore the high risk factors of hip joint abnormality in children with cerebral palsy by comparing the abnormality rate of hip joint between different birthplaces, gender, dyskinesia and limb disability of children with cerebral palsy.

- To provide guidance for early diagnosis and treatment by analyzing the relationship between the birthplaces, dyskinesia types and head imaging of children with cerebral palsy.

Methods

Setting

This study was conducted at five rehabilitation institutions in October 2014: The Rehabilitation Department of the Second Affiliated Hospital of Anhui Medical University in Hefei, The Second People's Hospital of Lu'an City, Jin'gu Rehabilitation Hospital, which provide inpatient and outpatient rehabilitation service to children with various disabilities such as brain injury and primarily CP. The other two rehabilitation institutions are Rehabilitation Research Center for the Disabled of Anhui Province and Rehabilitation Research Center for the Disabled of Fuyang city, both of which provide outpatient rehabilitation service to children with various disabilities such as autism, deaf-mutism and primarily CP. Ethical approval for the study was obtained from the ethics committees of all five institutions.

Participants

Inclusion criteria for the cerebral palsy children were as follows: (a) According to the diagnostic criteria of cerebral palsy developed by the children's rehabilitation professional committee of China rehabilitation medical association in 2014: central dyskinesia persists; abnormal movement and postural development; abnormal reflexes; abnormal muscle strength and muscle tension [2].(b) All the children were 1-12 years old and were willing to take part in the study. Before the investigation began, informed consent was obtained from all participants and the study protocol was approved by the ethics committees of all our institutions

Instruments

To record information of the CP children, a questionnaire was designed. The questionnaire include several questions of children with CP (age, gender, birthplace, head imaging features, hip joint imaging features, limb disability types, dyskinesia

types). The birthplaces are divided into countryside and city. The birthplaces of the countryside include community and township level health centers and home. The birthplaces of the city mainly refer to the hospitals of 2A and above. The head and hip imaging are divided into normal and abnormal. Head imaging refers to head MRI or CT, and the hip imaging is a pelvic X-ray film. The types of limb disability for cerebral palsy include quadriplegia, hemiplegia and others (three limb paralysis, paralysis, diplegia). The dyskinesia types include spastic, dyskinetic/ataxic, hypotonic and mixed.

Procedures

This study was conducted via personal interview and consisted of two main elements. Information was gathered on the demographic and clinical characteristics of their children. After the interview session, pediatricians specialized in neurological rehabilitation performed a detailed physical examination for the children and made a detailed record.

Analysis

SPSS-16.0 software package was used for statistical analysis and $P < 0.05$ was accepted as statistically significant. The Chi-square test was used to test for differences between groups.

Results

The data of a total of 198 children with cerebral palsy (1-12 years old) were collected. The abnormality rate of hip joint imaging was not correlated with the birthplace ($p=0.717$), the limb disability type of cerebral palsy ($p=0.535$) and the gender of the children ($p=0.479$). The abnormality rate of hip joint was statistically different in different dyskinesia types of cerebral palsy ($p=0.043$). The abnormality rate of hip joint in children with hypotonic and mixed cerebral palsy was relatively high (41.94%, 45%). There was no statistical difference between different birthplaces in the abnormal rate of head imaging in cerebral palsy children ($p=0.464$). The abnormality rate of head imaging is statistically different in different dyskinesia types in cerebral palsy ($p=0.004$), and the abnormality rate of head imaging is higher in children with hypotonic and mixed cerebral palsy (87.1%, 90%) (Tables 1 and 2).

Table 1. Analysis of correlation factors of hip joint imaging.

Hip joint imaging	Abnormal	Normal	P value	Hip joint imaging	Abnormal	Normal	P value
Birthplaces			0.717	Gender			0.479
Countryside	18	43		Male	32	91	
City	37	100		Female	23	52	
Dyskinesia			0.043	Limb disability type			0.535
Type							
Spastic	28	97		Quadriplegia	34	80	
Dyskinetic /ataxic	5	17		Hemiplegia	4	18	

Hypotonic	13	18		Other(three limb paralysis, paralysis, diplegia)	17	45	
Mixed	9	11					

Table 2. Analysis of the related factors of head imaging.

Head imaging	Abnormal	Normal	P value	Head imaging	Abnormal	Normal	P value
Dyskinesia			0.004	Birthplaces			0.464
Type							
Spastic	83	42		Country	45	16	
Dyskinetic /ataxic	11	11		City	94	43	
Hypotonic	27	4					
Mixed	18	2					

Discussion

In the aspect of secondary musculoskeletal dysfunction of children with cerebral palsy, the developmental dysplasia of the hip is the second major impairment of skeletal muscle system after equinus deformity [7].The development of the hip in children with cerebral palsy is normal at birth. At about 2 years old, there is dysplasia of the hip characterized by lateral femoral head migration. At about 4-12 years old, hip dislocation could occur. Nearly 25% to 75% of cases will eventually advance to painful and degenerative hip arthritis that affect daily life, which commonly occur from the second 10 years after birth. Most of them presented with a variety of manifestations of hip disability, mainly due to the hip pain, with unstable control of the lower limbs and limited activity of the hip joint, resulting in a decline in quality of life and impaired daily living ability [7-14].

In this study, the probability of dysplasia of the hip joint was up to 42.5%, but there was no statistical difference compared with hemiplegia and double paralysis (p=0.535). Some studies have shown that the hip dysplasia of cerebral palsy children, especially hip subluxation or subluxation, associated with gross motor grade and dyskinesia type. The risk of hip dislocation is the highest in children with four limbs paralysis. The risk of children with hemiplegia is the smallest. The poorer the motor function of children with cerebral palsy is, the more likely they are to have dislocation of the hip [13-14]. In the hypotonic and mixed cerebral palsy, the probability of hip joint abnormality is higher (41.94%, 45%), which is statistically different compared with that of spastic and dyskinetic cerebral palsy (p=0.043), which is inconsistent with some reports. These reports suggest that children with spastic, dyskinetic and mixed cerebral palsy are prone to dislocation of the hip. The hypotonic type has less dislocation of the hip joint, and the ataxic type of cerebral palsy is rarely accompanied by dislocation and subluxation of the hip joint [14]. The rate of hip dysplasia in children with cerebral palsy has not been found to be related to the birthplace and gender (P>0.05). This suggests that the birth environment and gender do not affect the abnormality of the hip joint. This is not consistent with the high risk factors for abnormal development of hip joint in infants, which may be related to the high

incidence of abnormal hip joint in children with cerebral palsy [15-17].

The majority of children with cerebral palsy were abnormal with head imaging, mainly manifested in Periventricular Leukomalacia (PVL), leukodystrophy, dysplasia of the corpus callosum, enlargement of the ventricle, and brain atrophy [18-19]. In this study, 198 children of cerebral palsy were included. The abnormality rate of head imaging was 70.2%, which was basically consistent with the related literatures [18,20]. In the correlation analysis between the dyskinesia types of cerebral palsy and head imaging, it has been found that the abnormality rate of head imaging is higher in children with hypotonic and mixed cerebral palsy (87.1%, 90%), and the difference is statistically significant, which is not consistent with relevant reports both at home and abroad. The head imaging of 25 children with cerebral palsy was analyzed by Zhou KS. They found the positive rates for spastic quadriplegia, hemiplegia, diplegia were 80%, 100%, 80% respectively, hypomyotonia 75% and mixed type 66.6%. The abnormality rate of head MRI of spastic cerebral palsy is the highest, and the pathological changes are mainly leukodystrophy[20]. In a study of 295 cases of cerebral palsy, MRI imaging of 257 cases indicates abnormality(the abnormality rate was 87.1%), 38 cases of normal persons (normal rate 12.9%), the brain malformation in 11 cases, periventricular leukomalacia (PVL) in 173 cases, cortical subcortical injury in 17 cases, 26 cases of basal ganglia damage injury, cerebellar dysplasia in 11 cases, and others(19 cases). The magnetic resonance abnormality rate in spastic cerebral palsy was the highest (91.8%) and the periventricular leucomalacia is the most common (72.6%). The abnormality rate of MRI in dyskinetic cerebral palsy children is 68.75%, with cerebral basal ganglia damage being the most common. The abnormality rate of MRI in ataxic cerebral palsy children is 92.3%, cerebellar hypoplasia being the most common [21], and the independent risk factor of cerebral palsy is PVL [22].

Conclusions

The hip joint and brain imaging abnormality rate of cerebral palsy children is extremely high, and we need to attach great

importance to the hip screening of children with cerebral palsy, especially for hypotonic and severe mixed quadriplegia children with cerebral palsy. We also need to strengthen the early intervention and guidance for cerebral palsy children born in the hospital of the rural areas and towns in China. Most of the children with cerebral palsy have head imaging abnormalities. And the head imaging examination has certain guiding significance for the diagnosis and prognosis of children with cerebral palsy.

If conditions permit, the routine examination of the hip and brain should be carried out in order to better guide the rehabilitation treatment of children with cerebral palsy.

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