Hip Instability In Cerebral Palsy

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Abstract

CP is a fixed non progressive damage of the brain, which occur before, during, or after delivery. There are two major problems in CP patients, hip instability and gait abnormalities. Hips usually dislocate posteriorly, due to the overactivity of the adductors and flexors of hip. The causative factors of hip problems in CP are the combinations of the following: muscle imbalance, acetabular dysplasia, pelvic obliquity and excessive femoral anteversion. The hip is normal at birth. Most often, the hip dislocates when the child is between 5 - 7 years of age. There are many surgical options: Hip contracture releases, varus or rotational osteotomy, and if necessary, a pelvic osteotomy.

Key words:

Cerebral palsy, CP, Hip dysplasia, Pelvic osteotomy, Hip dislocation, Surveillance.

Contents

Chapter 5

Figures

Tables

Lists of abbreviations

Ach	Acetyl-choline
AI	Acetabular index
AP	Antero-posterior
ASIS	Anterior superior iliac spine
CMV	Cytomegalovirus
CNS	Central nervous system
CP	Cerebral Palsy
CT	Computed tomography
DDH	Developmental dysplastic hip
DJD	Degenerative joint disease
GMFCS	Gross Motor Function Classification System
GMH	Germinal matrix hemorrhage
HBOT	Hyperbaric oxygen therapy
HIE	Hypoxic-ischemic encephalopathy
HTE angle	Horizonral toit externe
ITB	Intrathecal baclofen
IVH	Intra-ventricular hemorrhage
MI	Migration index
MP	Migration percentage
MRI	Magnetic resonance imaging
NSA	Neck shaft angle
OSSCS	Orthopedic Selective Spasticity Control Surgery
PIVH	Periventricular-intraventricular hemorrhage
PVL	periventricular leukomalacia
ROM	Range of motion
SCFE	Slipped capital femoral epiphysis
SDR	Selective dorsal rhizotomy
US	Ultra-sound
VDRO	Varus derotational osteotomy
WGH IV	Winters, Gage and Hicks hemiplegia group IV

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English Summary

CP is a fixed non progressive damage of the brain, which occur before, during, or after delivery. There are two major problems in CP patients, hip instability and gait abnormalities. Hips usually dislocate posteriorly, due to the overactivity of the adductors and flexors of hip. Bony deformities occur later in a response to the spasticity. The causative factors of hip problems in CP are the combinations of the following:

- Muscle imbalance
- Acetabular dysplasia
- Pelvic obliquity
- Excessive femoral anteversion
- Increased femoral neck valgus
- Lack of weight bearing

These conditions cause hip pain, restriction of motion, and difficulties with sitting and perineal hygiene.

The hip is normal at birth. Most often, the hip dislocates when the child is between 5 - 7 years of age, taking approximately two years from first evidence of subluxation. Often the first clinical indication of subluxation is heralded by inability to abduct more than 45°.

Clinical evaluation of the hip joint spasticity does not provide an objective reproducible data. In the radiological measurements of the hip joint instability the migration percentage and migration index is used.

Hip contracture releases should be carefully tailored, taking into consideration the severity, location, child's age, and walking potential. Release of all contractures at one operative setting is usually best. Avoid overcorrection. The soft tissue releases may be combined with varus, rotational osteotomy, and if necessary, a pelvic osteotomy.

In acetabular insufficiency, pelvic osteotomy is necessary to obtain the stability. In older patients with painful subluxation or dislocation, hip arthrodesis or total hip replacement should be recommended.

Chapter 1

Introduction

Introduction

Cerebral Palsy (CP) is a disorder of movement and posture that appears during infancy or early childhood. It is caused by non-progressive damage to the brain before, during, or shortly after birth. CP is not a single disease but a name given to a wide variety of static neuromotor impairment syndromes occurring secondary to a lesion in the developing brain. The damage to the brain is permanent and cannot be cured but the consequences can be minimized. Progressive musculoskeletal pathology occurs in most affected children. The lesion in the brain may occur during the prenatal, perinatal, or postnatal periods [Table1]. Any non-progressive central nervous system (CNS) injury occurring during the first **2** years of life is considered to be CP. In addition to movement and balance disorders, patients might experience other manifestations of cerebral dysfunction. [1] [Table2]

[Table 1] Time of brain injury	
Prenatal period	Conception to the onset of labor
Perinatal period	28 weeks intrauterine to 7 days postnatal
Postnatal period	First 2 years of life

[Table 2] Manifestations of cerebral palsy		
Neurological	**Musculo-skeletal**	**Associated problems**
Muscle weakness	Contractures	Intellectual impairment
Abnormal muscle tone	Deformities	Epilepsy
Balance problems		Visual problems
Loss of selective control		Hearing loss
Pathological reflexes		Speech and communication problems
Loss of sensation		Swallowing difficulty
		Feeding difficulty, failure to thrive
		Respiratory problems

CP is the most common cause of childhood disability in Western societies. The incidence is **2-2.5/1000** live births. Some affected children do not survive and the prevalence varies between **1-5**/1000 babies in different countries. It was previously thought that improvements in perinatal and obstetric care would decrease the incidence of CP. However, the incidence has not declined and the overall prevalence

increased during the 1980s and 1990s. This is explained by increased survival of premature and very low birth weight infants and by a rise in the number of multiple births. [2]

The **etiology** of CP can be identified only in **50%** of the cases. Certain factors in the history of the child increase the risk of CP. The incidence of CP among babies who have one or more of these risk factors is higher than among the normal population. The clinician should therefore be alerted to the possibility of the presence of CP in a patient with these factors. [1] [Table3]

[Table3] Risk factors in CP

Prenatal	Perinatal	Postnatal
Prematurity (gestational age less than 36 weeks)	Prolonged and difficult labor	CNS infection (encephalitis, meningitis)
Low birth weight (less than 2500 g)	Premature rupture of membranes	Hypoxia
Maternal epilepsy	Presentation anomalies	Seizures
Hyperthyroidism	Vaginal bleeding at the time of admission for labor	Coagulopathies
Infections (TORCH)	Bradycardia	Neonatal hyperbilirubinemia
Bleeding in the third trimester	Hypoxia	Head trauma
Incompetent cervix		
Severe toxemia, eclampsia		
Drug abuse		
Trauma		
Multiple pregnancies		

A whole group of **congenital developmental deformities** lead to CP. These deformities result from defects that occur in normal development and follow patterns based on failures of normal formation. A defect of the neural tube closure is the earliest recognized deformity leading to survival with motor defects. In the brain, the neural tube defect is called an encephalocele, and may be anterior, with a major midface or nasal defect. Most children with significant encephaloceles have very

significant motor impairments, usually quadriplegic pattern involvement with more hypotonia than hypertonia. [3]

Segmental defects in the brain are called schizencephaly, meaning there is a cleft in the brain. [4] These schizencephalies vary greatly, from causing minimal disability to causing very severe quadriplegic pattern involvement, usually with spasticity and mental retardation.

Lissencephaly, meaning a smooth brain, or a child with decreased cerebral gyri usually leads to severe spastic quadriplegic pattern involvement, but there is a significant range of involvement. [3]

Another part of normal development of the brain in the neonatal and prenatal period requires formation of the synapses and then subsequent remodeling of this neuronal synapse formation. As the cells migrate into the correct position and initially form their synapses, many of these premature synapses need to be remodeled through the influence of external stimuli for normal function to develop.

Prematurity and **brain hemorrhages** are much better understood since the widespread use of cranial ultrasound, in which the infant brain can be imaged through the open anterior fontanel. A common grading system for the severity of these hemorrhages shown in [Table 4]. [5]

[Table 4] Grading system of brain hemorrhage	
Grade I	Germinal matrix hemorrhage only
Grade II	Hemorrhage in the lateral ventricle and dilation of the lateral ventricle
Grade III	Ventricular system enlargement
Grade IV	Periventricular hemorrhage and infarctions

Hypoxic events occurring around delivery, usually in full-term infants, also lead to disability, with most of these children developing severe quadriplegic pattern involvement with severe mental retardation.

Shaken baby syndrome occurs usually in a child less than 1 year of age when a caretaker shakes the baby back and forth to quiet the crying. This vigorous shaking causes stretching, shearing, and tearing of the long axons and capillaries in the cortex of the brain. If these babies survive,