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Research

The Quality of Life of Children with Cerebral Palsy after Intensive Rehabilitation

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Abstract

The musculoskeletal abnormalities found in children with spastic cerebral palsy have an impact on quality of life, even in ambulant children. Quality of life has become an important therapeutic goal, particularly in chronic diseases such as CP. The Pediatric Quality of Life Inventory Scale (PedsQL) is one of the generic scales used to measure the quality of life in children with CP; it covers the physical, psychic and social domains. Current evidence is not strong enough to determine the optimal regimen of rehabilitation (intensity, pace, duration) for children with CP. However, regular physiotherapy has proved more effective and the best results are obtained by an early and intense intervention. In the literature, maternal age beyond 35 years and multiple births are associated with high risk of cerebral palsy.Our goal was to evaluate the quality of life of children with spastic CP after an intensive rehabilitation program with consideration given to the sibling rank and the age of the mother during childbirth.

Methods: Seventy-two children with CP, classified as GMFCS I to GMFCS III with lower limb spasticity, were included. An intensive rehabilitation program was followed by all patients. All participants received three sessions of physiotherapy and one session of occupational therapy per week, with close parental collaboration during home sessions. Each session endured one hour, and included muscle strengthening training, the task-oriented approach, and hydrotherapy sessions in the pool. A measure of quality of life with the Pediatric Quality of Life Inventory Scale (Peds QL) was assessed before the start of the intensive rehabilitation program and 6 months after the conclusion of the program.

Results: In our population, the sex ratio was 0.95 with 51.40% of Girls and 48.60% of boys. There were 30.6% cases of unilateral forms and 69.4% cases of bilateral forms. The mean age of the mother at the birth of the child was 28.9 ± 6 years with extremes ranging from 19 to 45 years. The child with a spastic CP was born the first of his siblings in 72.2% of cases. The most common etiologies were neonatal distress (55.6%), followed by prematurity (41.7%), and low birth weight (40.2%). Disorders associated with motor impairment in CP were dominated by ocular strabismus (31.9%), speech impairment (15.3%), and epilepsy (12.5%). Additionally, minor cognitive impairment was diagnosed in 4.2% of the cases. MRI revealed periventricular leukomalacia in 23.6% of the cases, while ischemic lesions were present in 6.9 % of the cases. The quality of life of children with CP after 6 months of intensive rehabilitation was significant (p=0.04).

Conclusions: In our sample, the mother's age during delivery was lower than that cited in the literature. Sibling rank was rarely mentioned. The quality of life of children with PC after 6 months of intensive rehabilitation was significant.

Introduction

Cerebral palsy (CP) is defined as a set of permanent disorders of development, movement and posture, leading to a limitation of activity, and which are caused by a non-progressive attack on the brain of a developing fetus or infant [1]. CP is the most common cause of motor disability in children. Children with CP are generally less active than their peers, with less involvement in social activities.

The prevalence of CP in countries with high economic potential (defined as the developed countries with their high and rising levels of per capita income) as European countries has been stable for 40 years: 1.77 per 1000 live births [2].

The prevalence of CP in a low economic potential country such as Africa is between 3.8 and 10 per 1000 live births [3].

The severity of CP is assessed by using the Gross Motor Function Classification System (GMFCS). This classification has five levels which address mobility and walking autonomy, with level I: being completely autonomous at the walking, and level V being completely dependent, requiring a wheelchair pushed by a third party [4].

The factors of occurrence of a cerebral palsy in children are classified by Cans (2005) in intrinsic risk factors, witnesses of a maternal and/or fetal pathology and in extrinsic factors, reflections of the mode of care in the pre or perinatal period [5]. Among the risk factors for cerebral palsy, element related to conception and/or pregnancy must be distinguished from those related to the modes of perinatal care (see table 1).

Intrinsic risk factors	Extrinsic risk factors
Prematurity (<32 weeks). Low birth weight (<1500 g). Intrauterine growth retardation. Gestational hypertension. An infection during pregnancy or at moment of birth. Multiple pregnancies. The male sex. Perinatal asphyxia. The mode of care in the pre or perinatal period (Use of surfactant and corticosteroid).	The mode of delivery.

Table 1: The risk factors of CP.

Central nervous system (CNS) lesions are present in 75% of cases on

MRI with periventricular white matter involvement in 56% of cases [6]. The spastic form is the most common, accounting for 85% of cases [7]. The definition of spasticity by Lance in 1980 is the most quoted in the literature: "Spasticity is a motor disorder characterized by an increase in reflex stretching tonicity with exaggerated osteotendinous reflexes, resulting from the hyperexcitability of the stretch reflex, considered a component of the upper motor neuron syndrome "[8] page (1311). Achache V, in 2013, states that spasticity is a symptom found only on clinical examination, expressed during a rapid stretch by an exaggerated phasic response, with the presence of a more or less important clonus, and/or a tonic type response by resistance to movement of varying intensity. Moreover, the lack of control selectivity is often associated with a "hypertonia" independent of the speed of stretching or contractions hindering the motor control [9]page (80).

Spasticity appears in the first months of development of the child with CP because of the decrease in the inhibition of the stretching reflex. Spasticity leads to changes in the muscle cell and the extracellular matrix [10]. Soft tissue retractions, which increase the passive stiffness of the muscle and reduce the range of motion, develop later in childhood [11].

Spasticity cannot be the determining cause of the development of muscle retractions [12]. Muscle retraction is one of the factors that cause excessive reactivity to stretching, which in turn aggravates retraction[13]. Muscle alterations in children with cerebral palsy stem from changes in the neural control of muscles and changes in muscle structure [14].

The clinically observed muscle retractions correspond to changes in the length of the sarcomeres, in the type of muscle fiber (decrease of the slow fibers), in the concentration of the connective tissue (collagen), in the rigidity of the bundles of fibers, and even in the decrease in the number of stem cells (satellites) [15, 16] with a higher content of intramuscular fat [17]. Deregulation of the costamers, calcium, the nuclear envelope of muscle fibers and mitochondrial dysfunction are also implicated in the formation of retractions in children with CP [14]. All these changes in skeletal muscle contribute to a decrease in muscle strength, length of the muscle-tendon unit, and an increase in reflex and passive resistance to stretching [18].

It is currently accepted that maintaining muscle strength in children with CP is important because there is a direct relationship between lower limb strength and overall motor function [23, 24].

Recent research has shown the role of muscle reinforcement in increasing strength and improving walking function [25, 26].

Quality of life (QOL) has become an important therapeutic goal, especially in chronic diseases such as CP [19]. Cerebral palsy can have profound effects on the physical, social, and emotional health and well-being of the child, including the parents. Quality of life is a very broad and multidimensional concept for measuring the physical, psychological, social and sexual well-being of a group of people in relation to health [20]. In particular, it is the subjective perception of a person, the subjective account of his quality of life across a number of dimensions [21].

This concept has been defined by the World Health Organization Quality of Life (WHOQOL) as an individual perception of the place of the individual in his life, in the context of the cultural and social system of value in which he lives, and in relation to his aims, hopes, standards and concerns [22]. In the context of rehabilitation, quality of life has clinical utility as an important health-related outcome measure that can guide practice and evaluate the effectiveness of rehabilitation interventions [23]. The determinants of quality of life gives us some insight into what factors (physical or psychosocial) may be important to consider for programs and interventions aiming to have an impact on quality of life. In Algeria, the integration of quality of life measurement in the medical approach remains limited in children with cerebral palsy, which is why we are interested in this measure for an overall evaluation of our patients with CP.

Material and Method

Seventy-two children with CP and lower limb spasticity (classified as GMFCS I to GMFCS III) were included in this study. An intensive rehabilitation program was followed by all patients. All participants received three sessions of physiotherapy and one session of occupational therapy per week, with close parental monitoring during home sessions. Each session endured for one hour. Therapies encompassed muscle strengthening training, the task-oriented approach, and hydrotherapy sessions in the pool ((a one-hour session per week). Three sessions per week of rehabilitation made of mobilizations of the joints of the lower limb concerned by spasticity (a minimum of five repetitions), followed by a stretching of the spastic muscles and postures in position of muscular elongation and concentric strengthening of the antagonistic muscles, using the weight of the body segments and physical resistance of the physiotherapist (three sets of ten repetitions) associated with focused motor training on balance and walking [24-26].

The session is associated with a therapeutic education of the child and his parents to avoid bad postures as well as teaching mobilizations, stretching, postures and reinforcements that will be done at home 2 times 30 minutes / day.

Parental monitoring at home is primarily aimed at the prevention of orthopedic disorders.

A measure of quality of life using the Pediatric Quality of Life Inventory Scale (PedsQL) was completed before the start of the intervention and 6 months after completion of the program.

Children with PC reside in Oran (Algeria) and local wilayas (especially in Mostaganem and mascara).

Results

In our population the sex ratio = 0.95 with 51.40% of Girls and 48.60% of boys.

There were 30.6% cases of unilateral forms and 69.4% cases of bilateral forms. The mean age of the patients was 7.56 ± 3.47 years with extremes ranging from 3 to 15 years. Of the 72 children in the study, 40.3% were classified as GMFCS I, 13.9% were classified as GMFCS II, and 45.8% were classified as GMFCS III.

The topographic forms of CP describe body parts affected by the disorder. Table 1 depicts the percentage of children characterized by a specific topography.

Topographic Forms	Numbers (%)
Hemiplegic	22 (30.6)
Diplegic	30 (41.7)
Triplegic	11(15.3)
Quadriplegics	9 (12.5)
Total	72 (100)

Table 2: Topographical Distribution of CP.

The mean age of the mother at the birth of the child was 28.9 ± 6 years with extremes ranging from 19 to 45 years. The child with a spastic CP was born the first of his siblings in 72.2% of cases. Table 3 depicts risk factors delineated in the study.

Risk factors of CP	-
Age of mother at birth of child	28.6±6 years
Rank of the child in the siblings	
The first	72.2%
The second	11.1%
consanguinity	15.3%
First degree	8.3%
Second degree	4.2%
Third degree	2.8%

Table 3: Risk factors of CP.

The most common etiologies amongst study participants were neonatal distress (55.6%), prematurity (41.7%), and low birth weight (40.2%). Other rarer etiologies are found and represented in the table 4.

Etiologies of Cerebral Palsy	Numbers (%)
Neonatal Suffering	40 (55.6)
Prematurity	30 (41.7)
Low Birth Weight	29 (40.2)
Postnatal Infection	7 (9.7)
Neonatal Jaundice	4 (5.6)
Head Trauma	1 (1.4)

Table 4: Etiologies of Cerebral Palsy.

Disorders associated with motor impairment in CP were dominated by ocular strabismus (31.9%), speech impairment (15.3%), and epilepsy (12.5%). Minor cognitive impairment was diagnosed in 4.2% of the cases.

Disorders Associated with CP	Numbers (%)
Strabismus	23 (31.9)
Language Disorders	11 (15.3)
Epilepsy	9 (12.5)
Cognitive Impairment	3 (4.2)

Table 5: Disorders Associated with CP.

Table 6 reveals MRI brain results of the children in the study. Periventricular leukomalacia was found in 23.6% of cases, while ischemic lesions were present in 6.9% of cases. MRI findings were normal in 12.5% of cases.

Brain MRI	Numbers (%)
MRI Not Completed	41 (56.9)
Normal (No Visible Brain Lesions)	9 (12.5)
Periventricular Leukomalacia	17 (23.6)
Ischemic Lesions	5 (6.9)
Total	72 (100%)

Table 6: Brain MRI .

The quality of life after Intensive Rehabilitation was statistically significant with (p = 0.04). The mean and standard deviations of the PedsQL score are shown in the table 7.

Quality of life (N=72)	Average ± DS	P
Before Treatment	40.78±15.18	-
6 Months Post Treatment	37.28± 15.20	0,04

Table 7: Quality of Life after Intensive Rehabilitation.

Discussion

The average age of study participants was 7.56 years ± 3.47, indicating a delay in taking care of this category of children and the possible installation of musculoskeletal disorders. This shows the extreme delay of current care in Oran in Algeria when we know that the prevention of musculoskeletal disorders must be very early before two years [27]. The biateral form of CP represents in our series 69.4% of cases dominated by diplegia in 41.7% of cases. The unilateral form is 30.6% of cases. Sellier and al. in 2016, reports a prevalence of 3.7 in children with bilateral spastic PC and a prevalence of 2.4 in children with unilateral spastic PC [2]. In our series, children had one or more identified risk factors. Among these risk factors, parental consanguinity was present in 15.3% of cases and is incriminated by some authors including Sinha G [28] and his collaborators in the pathogenesis of CP. They reported that 51.7% of children with CP were from first-degree consanguineous marriage (See Table 3).

The mothers of the CP children were relatively young, aged on average 28.9 ± 6 years old and most of them were primiparous at the birth of the child concerned. In the literature, maternal age greater than 35 years and multiple births are associated with high risks of cerebral palsy [29]. In our series, children who were spastic walkers were born the first of their brothers and sisters in 72.2% of the cases.

Several associations of etiologies were found in our study population. These associations were 40.3% of cases, dominated by neonatal distress prematurity and low birth weight.

Neonatal distress is the most common and affects 55.6% of cases, prematurity is present in (41.7%) of cases and low birth weight in (40.2 %) of cases. The weight of the child at birth was on average 2700 g ± 953g in our series.

Erkin (2008) in Turkish series, reported the same etiologies with the presence of low birth weight in (45.1%), preterm birth in (40.5%) and birth asphyxia in (34.6%) [30].

Other etiologies, particularly postnatal infections, neonatal jaundice and head trauma are more rarely found in our series. However, we were unable to identify risk factors in 12.5% of cases. In addition to motor impairment, other disorders were frequently associated with the children in our study population: epilepsy (12.5%), ocular strabismus (31.9%), speech impairment (15.3%), and minor cognitive impairments (4.2%).

Currently, magnetic resonance imaging (MRI) is the gold standard for identifying brain injury in children with CP. Recently, Fiori et al. (2015) [31] developed an MRI classification correlated with the severity of the CP. In our study, brain MRI was normal in 12.5% of patients who had undergone neuroradiologic exploration. Reid et al. (2015) [32] reported that 14% of children clinically diagnosed with CP show no signs of brain injury on MRI. However, brain lesions in cases of CP are not always visible on MRI.

In our series, these brain lesions were identified in 30.5% of the children: periventricular leukomalacia (23.6%) and ischemic lesions (6.9%).

In the literature, the involvement of the periventricular white matter is found in 56% of cases [6]. It is most often due to ischemia-hypoxia. Spastic cerebral palsy is associated with cerebral lesions in the cortical motor zones and in the periventricular white matter. In general, lesions of the latter are associated with mild and moderate motor deficiency of spastic CP with fewer accompanying disorders (Himmelmann and Uvebrant, 2011) [33]. This aspect is noted by our study.

More than half of the children in our series did not have brain MRIs, given parents' low socio-economic status.

In our series, the limitations of the range of motion affected: Bilateral hip abduction in 26.22% of cases with an average of 26.16 ± 6.99 °, Hip extension in 20.49% of patients case with an average of 9.17 ± 7.63 ° on the right and 7.50 ± 7.23 ° on the left,

The extension of the knee in 31.69 % of the cases, with a flexum on the right of 11.85 ± 5.93 ° and 13.21 ± 5.93 ° at the left.

The dorsal flexion of the ankle in 25.40% of the cases with an equinus of 12.31 ± 6.95 ° on the right and 13.89 ± 6.76 ° left.

Nordmark et al. (2009) have reported a gradual decrease in the average of these same articular magnitudes during the growth of children with CP between two and fourteen years, depending on the level of GMFCS and the subtype of CP. This finding is important, both for treatment and for follow-up planning for each child with CP [34].

Torsion abnormalities such as excess femoral neck antétorsion are found in 29.50% of cases.

This draws our attention to the prevention of postures that aggravate femoral antetorsion such as sitting between tallons, and the need for early verticalization of children with delayed standing and walking. Excessive external tibial torsion was present in 26.22% of cases in addition to excess femoral antetorsion, and patella Alta found in 18.03% of cases.

Foot varus was present especially in the unilateral form and rep-

resents 25.40% of cases.

Anteversion of the pelvis was a common disorder in our study sample. It was found in 56.9% of cases, especially in the bilateral form. Bernard JC et al. (2014) have identified pelvic incidence disorders in spastic CP children. They found a tendency for pelvic retroversion in cases of crouching, and a pelvic anteversion in true equines [35].

The consequences of these various disorders noted on the admission of may influence, to varying degrees, the response to treatments initiated in these patients.

Overall, the quality of life of our study population improved on average in a statistically significant manner with (p=0.04).

Conclusion

In our sample, the mother's age during delivery was lower than that cited in the literature. Rank in the siblings was rarely mentioned. The quality of life of children with PC after 6 months of intensive rehabilitation was significant.

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