Original Article

Orthopedic Lower Limb Deformities in Cerebral Palsy: A case series

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Abstract

Introduction: One-third of children with cerebral palsy (CP) do not yet walk at the age of 5. Orthopedic deformity is one of the pathologies that may compromise the efficiency of gait in those patients. The aim of our study was to describe the clinical characteristics of orthopedic deformities for CP patients and to describe device prescription to manage the deformities. **Methods:** A retrospective chart review was conducted at the Equipment Teaching Hospital of Madagascar, after ethic committee approval, during a period of 1 year, from the beginning of January 2017 to the end of December 2017. Patients diagnosed with CP, during the period of the study, regardless of age and gender, were included in the study. Incomplete patients' records have been excluded from the study. The different types of orthopedic deformities were analyzed. **Results:** New cases of CP were in the order of 5.61% (n = 100) in 1783 new patients seen in consultation during 2017. Ninety-five patients were kept out. Eighty-nine percent of patients reported to the hospital after 12 months of age. Orthopedic deformity was detected in 48 patients, including 27.36% with deformity of the foot, 5.26% of the knee, 4.21% of the hip, and 16.84% of the spine. More than 73% of the patients had spasticity. In 45.26% of the cases, patients with CP had a complete functional restriction with a Gross Motor Function Classification System V (GMFCS), and only 27 patients had GMFCS I or II. In 82.1% of the cases, patients with CP needed devices to reduce their deficit or maintain functional gain. **Conclusion:** CP is a public health problem. Orthopedic deformities are often discovered late, affecting the gait quality for these patients. Orthopedic deformities prevention is crucial, and multidisciplinary care should be done early.

Keywords: Cerebral palsy, devices, orthopedic deformity

Introduction

Cerebral palsy (CP) is a syndrome mainly characterized by nonprogressive motor disorders associated with primary lesions occurring at an early stage of the brain development.[1] It affects about 2 children per 1000 live births.[2,3] The progression of joint deformity can compromise the standing position and walking efficiency.[4] One-third of children with CP do not walk at 5 years of age. The ability to walk is further reduced in children with associated deficits in addition to the motor deficit.[3] Deformities of the foot and ankle are common among patients with CP. Ankle–foot orthosis (AFO) is the most frequently used type of orthosis in children with CP.[5] In Madagascar, few studies have been carried out on the patient, and treatment is not standard. The aims of our study were to describe the clinical features of orthopedic deformities in patient with CP and to describe the device prescription practices.

Methods

A retrospective chart review was performed at the Equipment Teaching Hospital of Madagascar, over a period of 1 year. Medical records from January 2017 to December 2017 were reviewed. Patients diagnosed with

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CP were included regardless of age or gender. Incomplete medical records were excluded from the study. Data collected included referral source, age of patients at the first consultation, etiologies of CP, presence of spasticity, orthopedic deformities observed, the Growth Motor Function Classification System (GMFCS) of patients, and the prescription modality of orthotic devices.

Results

New cases of CP were in the order of 5.61% (n = 100) of 1783 new patients seen in the hospital during 2017. Ninety-five patients were kept out. Nearly half of the cases were referred by a health center, and the half of the cases were self-referred patients. Boys (n = 53) were more affected than girls (n = 42) with a sex ratio at 1.23. In 10.5% of the cases (n = 10), children were seen in consultation before the age of 12 months [Table 1]. In 45% of cases, anoxic-ischemic encephalopathy related to neonatal asphyxia was the cause of CP. In 14% of cases, the etiology was not known [Figure 1]. Sixty-nine patients (72.63%) had spasticity. More than half of the patients had orthopedic deformity, which mainly affects the feet and the ankle (27.36%) and spine (16.84%) [Table 2]. The frequency of the orthopedic deformations was different according to age groups [Figure 2]. Kyphosis deformity of the spine was discovered in the 1st year of life; older children aged from 6 to 11 years were the most affected. Foot and ankle deformities were seen from 12 months and predominated in the 12–23-month age group. In 45.26% of the cases (n = 43), the patients had the Gross Motor Function Classification System V (GMFCS) [Table 3]. Seventy-eight patients (82.1%) received a device prescription. One-third of children (n = 29) have benefited a molded seat [Figures 3 and 4]. AFOs (n = 6) were the most prescribed device for ambulatory patients [Table 4].

Discussion

The frequency of 5.61% of CP was lower than the frequency found previously by Ramanatsoa,[6] which is 22.29%. Almost half of the patients were self-referred; however, the majority of patients had etiological arguments for CP [Figure 1]. It is crucial to diagnose CP as early as possible in order to provide specific care to patients. Spinal deformities were detected in the 1st year of life [Figure 2], whereas only 10.53% of children have been consulted before the age of 12 months [Table 1]. Eleven (11.57%) of our patients had scoliosis. The incidence of scoliosis in patients with spastic diplegia is 5% compared to 65%–74% in patients with spastic quadriplegia.[7] Spinal deformity should be detected early; kyphosis is common for young children, whereas scoliosis is more frequent and more severe for pubertal children.[8-10] The first signs of puberty must be noted since scoliosis will worsen rapidly during the puberty phase when the growth of the trunk increases rapidly.[8] Thirty-one patients received a foot orthosis prescription [Table 4]. Foot assessment must take into account the age of the child and the evolution with growth.[11] The presence of spasticity is more commonly associated

Table 1: The distribution of patients by age group

Age range	Number of patients (n=95), n (%)
6-11 months	10 (10.53)
12-23 months	17 (17.89)
2-3 years	23 (24.21)
4-5 years	13 (13.68)
6-11 years	23 (24.21)
12-17 years	7 (7.37)
18-30 years	2 (2.11)

Table 2: The frequency of orthopedic deformities according to joint

Localization	Type of deformities	Number of patients	Frequency (%)
Foot/ankle	Flat foot	4	27.36
	Supinatus	3	
	Valgus	4	
	Varus	2	
	Equinus	2	
	Flat foot + valgus	6	
	Varus equinus	5	
Knee	Valgus	2	5.26
	Recurvatum	3	
Hip	Dislocation	4	4.21
Spine	Thoracic kyphosis	5	16.84
	Scoliosis	11	

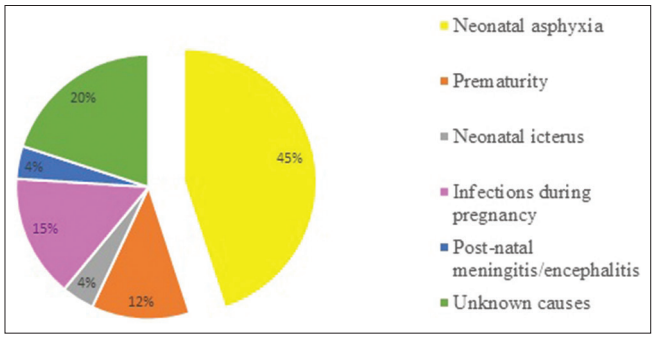

Figure 1: The etiologies of cerebral palsy

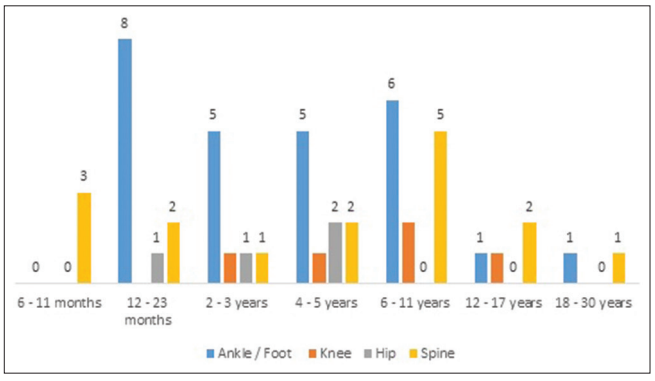

Figure 2: The frequency of orthopedic deformities by age group

Figure 3: A 4 year old boy with spastic CP sitting on a molded seat

Figure 4: A 4 year old boy with spastic CP sitting on a molded seat; the left foot corrected by an ankle–foot orthosis

Table 3: Distribution of patients according to the Gross Motor Function Classification System V

GMFCS	Number of patients (*n*=95), *n* (%)
I	7 (7.37)
II	20 (21.05)
III	17 (17.89)
IV	8 (8.42)
V	43 (45.26)

GMFCS: Gross Motor Function Classification System V

Table 4: Distribution of devices prescribed in the center

Type	Frequency, *n* (%)
Orthopedic shoe	10 (10.53)
Foot orthosis	13 (13.68)
Heel cup	5 (5.26)
Ankle/knee night splint	3 (3.16)
Molded seat	29 (30.53)
Standing frame	9 (9.43)
Thoracolumbosacral orthosis	8 (8.42)
Ankle-foot orthosis	6 (6.32)
Knee orthosis	2 (2.11)
Knee-ankle-foot orthosis	1 (1.05)
Hip-knee-ankle-foot orthosis	2 (2.11)

with ankle equinus deformity.[9,12,13] Only 27 patients had GMFCS I and II [Table 3]. On 102 children with an average age of 8.46 ± 3.9 years, Dziri *et al*.[9] observed 86.7% of neuro-orthopedic predominant deformities in the lower limbs, and 72% of the children were not independent for walking. Nonambulatory children have a higher predisposition for spinal deformities. In contrast, Sanou *et al*. found an incidence of only 7.5% orthopedic deformities in 174 patients with CP. Interventions can be standardized by therapeutic protocols depending on the severity of the injury and the potential of the child, which allow longitudinal follow up of patients.[14] The management of impairments should be done earlier and nonsurgical as possible[15] because growth and spasticity create joint deformities, which are first latent, discrete, then obvious but reducible, and finally irreducible.[15,16] Devices supplement rehabilitation management completes the rehabilitation care; its prescription is implemented systematically in the children with CP to prevent secondary complications.[17,18] The spasticity is a problem faced by patients with CP; they will fight against the posture and cannot support anymore their devices.[19] Spastic muscles will have difficulty to adapt with bone growth; they will retract over time. The retracted muscles will exert forces on the joint that will deform. Orthopedic deformities will, therefore, progress. Spasticity was noted in 72.63% of our CP patients. Botulinum toxin injection often allows muscle stretching and facilitates the fitting tolerance of the device.[20,21] None of our patients had received a botulinum toxin injection, and with the severity of the deformity, the choice of equipment was limited. In our practice, spasticity is managed by stretching exercises, postural exercises, and devices as appropriate. The postural orthosis, the molded seat, and the standing frame help to maintain a prolonged muscular stretching.[16] In CP children with severe motor impairment, the molded seat was the most prescribed and individually adapted [Table 4]. This seat corrects the posture, prevents the accentuation of deformities, frees the upper limbs, and allows the individual to have a good proprioceptive reference of the axis of the body.[22] Optimal clinical decision-making to improve the gait through orthotic management requires an understanding of the biomechanics of the foot and ankle during normal gait, pathophysiology and pathomechanics of gait dysfunction in children with CP, and biomechanical characteristics of various orthoses.[23] AFOs improve the speed and length of strides;[24] for a functional purpose, this orthosis was chosen in 6.32% of our patients [Table 4] to improve the performance and quality of walking. Orthopedic shoes were prescribed in 10.53% of the cases [Table 4]. These shoes were customized for a better correction of the static of the foot and to decrease the risk of deformities.[25]

Conclusion

CP is a public health problem. Orthopedic deformities are often discovered late, affecting the efficiency of gait for patients with CP. Multidisciplinary care should be done early. Devices are not meant to be used in isolation but should be incorporated to the patient's management in addition to other therapeutic interventions. It has an important complementary role in the prevention and correction of orthopedic deformities, contributes to the improvement of performance and the quality of walking.

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Conflicts of interest

There are no conflicts of interest.

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