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PHYSIOTHERAPY ASSESSMENT OF CANAVAN DISEASE: CASE REPORT

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ABSTRACT

Background: This study aimed to present symptoms related to physiotherapy of Canavan Disease (CD) and evaluation of these symptoms.

Methods: In physiotherapy evaluations of the child included gross motor function measurement (GMFCS), muscle tone evaluation with Modified Ashworth Scale, Reflex Evaluation (Patellar reflex, Achilles reflex and clonus), musculoskeletal system assessment (range of motion measurement, anthropomorphic measurements and muscle shortness tests).

Results: The disability level of our case according to the GMFCS was level V. The patients were hypotonic. Except the tonus and reflex evaluation, asymmetry was found between the right and left side in other measurement.

Conclusion: To prevent the secondary deformities in CD, we believe that it is important to create a physiotherapy program aimed including correct positioning for 24 hours and the symmetric loading to the musculoskeletal system.

Key Words: Canavan Disease, physiotherapy, assessment.

INTRODUCTION

The disease defined by Myrtle Canavan (1), referred to by various names but with is defined as Canavan Disease (CD) since 1931. CD is located in spongiform leukodystrophy group and is a rare autosomal recessive genetic disease that causes insufficient secretion of enzymes called aspartoacylase. Aspartoacylase is highly released in oligodendrocytes and is an enzyme responsible for the hydrolysis of N-acetyl-L-aspartate (NAA) (2). Due to the lack of activity of aspartoacylase, swollen astrocytes and demyelination problems such as elongated mitochondria is observed in the central nervous system in MRI (2,3).

CD is mostly seen in the Ashkenazi Jewish although there is often visible to other ethnicities (3). The babies have appearing normal images at birth. The symptoms of CD appear in early infancy and progress rapidly. These symptoms include lethargy, mental retardation, feeding difficulties, abnormal muscle tone, poor head control and abnormally enlarged head. With time, paralysis, blindness, or hearing loss may occur (1,2,3,4).

There is no cure for CD, treatment is symptomatic and supportive. Up to now while in studies more focused on genes and medical treatment (2), no study found on physiotherapy of CD. The purpose of this study is to present symptoms related to physiotherapy of CD and evaluation of these symptoms.

MATERIAL AND METHODS

Case Presentation

This study was carried out on a case of 9-year-old female. Patient's height 129 cm, weight 18 kg and body mass index was below the normal range. There were no family relationship to the patient's family and had no family history.

When she was 6 months, her parents have noticed slowing and declining in the development of baby. The patient's parents applied with this complaint to the University Hospital to Neurology Department and Canavan Disease was diagnosed at the age of two. In MRI, myelin sheath damage was remarkable. Patient had no eyes contact, voluntary muscle activity and speech. However against painful stimulus she removed unidentified sounds. Deep tendon reflexes were hyperactive. Babinski sign and Achilles clonus were positive in patient. To keep upright the body of the patient

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was using an apparatus and ankle foot orthosis (AFO) for dorsi flexion.

Outcome Measurements

1. **Gross Motor Function Classification System (GMFCS):** The functional level was assessed using the GMFCS. GMFCS is used in particular to determine the functional level of children with CP and some other diseases. Functional level is scored in the range '1-5'. While '1' shows minimum speed, balance and coordination problems despite independent mobility, '5' indicate completely dependent mobilization and movement (5).
2. **Modified Ashworth Scale**: To evaluate the presence and severity of spasticity was used Modified Ashworth Scale. Modified Ashworth Scale as a rating scale to measure abnormality in tone or the resistance to passive movements. The scale was composed of 5 items. 0 and 4 scores refers to respectively; normal muscle tone, rigid joint in flexion or extension.
3. **Reflex Evaluation:** Patellar reflex, Achilles reflex and clonus reflex evaluation was performed.
4. **Musculoskeletal System Assessment:** Bilateral lower and upper limbs range of motion measurement, anthropomorphic measurements (circumference, length) and muscle shortness tests were performed.

RESULTS

According to the GMFCS, the disability level of our patients was level V (no head control and assisted sitting). Muscle tonus of ankle plantar flexor, ankle ınvertor and forearm flexor was found 2. Other muscle groups were observed hypotonic. Muscle tone assessments of patient shown in Table 1.

In deep tendon and pathological reflexes assessment; there was no response to triceps reflex but other reflex was normal (Table 2). Active motion was not in upper extremity and lower extremity muscles but the passive range of motion was full. We found that all extremities were hypotonic (Table 3). Except the tonus and reflex evaluation, asymmetry was found between the right and left side in other measurement.

DISCUSSION

Canavan disease (CD) which is a rare, progressive and deadly form of pediatric congenital leukodystrophy that lead to spongy neurodegeneration had devastating effects (4,6). Canavan disease occurs due to mutations in the gene ASPA encoding the enzyme aspartoacylas (7,8). In DNA analysis in CD patients in a number of different and common mutations and more than 54 dysfunction associated with these mutations have been identified (6,8). These mutations in ASPA gene cause the accumulation of N-acetyl aspartic acid (NAA) and lack of ASPA in the brain (4). NAA concentration in the interstitial spaces of high subcortical white matter has complex effects (7). Although function of NAA currently unknown exactly, it is reported NAA accumulation in the mitochondria inhibits the synthesis of myelin (2,8). Despite CD can be seen in all the races in the World, it is more common in Askenazi Jews (3). In addition, babies are normal at birth, CD symptoms begin to seen in the first 6 months (2,3). Our 9-year-old female patient had a normal appearance at birth, within 6 months symptoms had been appeared and she was 2 years old, diagnosed with

Table 1. Muscle Tone Assessment

Muscle Groups	Modified Ashworth Scale Scoring	
Lower Extremity	**Right Side**	**Left Side**
Hip Muscles		
Flexor / Extensor	HT / HT	HT / HT
Adductor / Abductor	HT / HT	HT / HT
Internal Rotator / External Rotator	HT / HT	HT / HT
Knee Muscles		
Flexor / Extensor	HT / HT	HT / HT
Ankle Muscles		
Plantar Flexor / Dorsi Flexor	2 / HT	2 / HT
Invertor / Evertor	2 / HT	2 / HT
Upper Extremity		
Shoulder Muscles		
Flexor / Extensor	HT / HT	HT / HT
Adductor / Abductor	HT / HT	HT / HT
Internal Rotator /External Rotator	HT / HT	HT / HT
Arm Muscles		
Flexor / extensor	HT / HT	HT / HT
Supinator / Pronator	HT / HT	HT / HT
Forearm Muscles		
Flexor / extensor	2 / HT	2 / HT

0 = normal muscle tone, 1 = slight increase in muscle tone, "catch" when limb moved, 2 = more marked increase in muscle tone, but limb easily flexed 3 = considerable increase in muscle tone, 4 = limb rigid in flexion or extension, HT: hypotonic muscle

CD. Because CD is autosomal recessive disease and is mostly seen in a population suggests that the disease may increase the incidence of consanguineous marriages (2,3). But there is no relationship between her parents of our female patients. Similarly eight-month baby who was examined by Sreenivasan had no family history and kinship between her parents (9).

Table 2. Deep Tendon and Pathological Reflexes Assessment

Reflexes	Right Side	Left Side
Biceps Reflex	**+**	**+**
Triceps Reflex	**-**	**-**
Patella Reflex	**+**	**+**
Achilles Reflex	**+**	**+**
Babinski	**+**	**+**
Achilles Clonus	**+**	**+**

Currently there is no treatment to stop the progression of the disease and advanced medical care is administered to these patients for the survival (6). However gene therapy has been investigated for CD (4). It was observed slowdown in progression of disease with gene replacement therapies for infants with CD (8). In one of these studies, ASPA gene therapy resulted in reduction high NAA levels in the brain and in seizure frequency, slowing the progression of brain atrophy, and the stabilization of the clinical status (7). Lots of studies drawn attention to more genes and medical treatment, but it has not been found any studies on physiotherapy assessment and treatment of the disease.

Gene therapy researches underline the importance of early intervention and emphasize improvement in young patients is much better than older. In comparison patients with CD grouped according to age, statistically significant improvements at gross motor function were found (6). These results demonstrate the importance of identifying a treatment method that extend the life expectancy of patients with CD and will help to improve the quality of life. So we believe that determining the physiotherapy program in the earliest time will contribute positively progression of disease. Besides, there are various opinions about disease progression, severity of symptoms and life-span. Various CD form that characterized by delaying in the onset of the disease, mild symptoms and slowly progression are defined. But all form of CD show severe retardation, inability of walking and speaking (1). When baby was 3-6 months, clinical signs of CD are seen. Patients head size that is normal at birth, starts growth by the time. First 6-10 months of life optic atrophy starts to develop and results in blindness. Hypotonia turns the spasticity. Flexion posture at upper extremity and extension posture at lower extremity improves (9). Initial symptoms of CD include hydrocephaly, head lag, ataxia, severe psychomotor retardation, brain vacuolization, seizures, hypertony. Demyelination cause death in early childhood (10, 11). 8 month old baby was examined by Sreenivasan et all had motor disability, generalized tonic-clonic seizures, hydrocephalus, visual fixation problems, spasticity, bilateral extensor plantar responses and abnormal reflexes (9). In Our 9-year-old female patient, conversation, eye contact and voluntary muscle movement were absent, had unidentifiable sounds off against the painful stimulus. According to GMFCS; functional level of patient was level 5. She hadn't head control and couldn't been seated with support. Severity of spasticity in ankle plantar and wrist flexors were '2', in elbow flexors were '1' bilaterally. However except these three muscle groups, other muscles were hypotonic. We thought common hypertonia may cause joint subluxation. Deep tendon reflexes had increased; Babinski and Achilles' clonus were also found in patients. Secondary musculoskeletal problems are emerging in children with neurological problems. In

Table 3. Musculoskeletal System Assessment

		Right Side	Left Side
Upper Extremity	Active Motion	-	-
	Passive Motion	In normal range	In normal range
	Atrophy	**+**	**+**
	Length (cm)	38	37
	Muscle Shortness	-	-
Lower Extremity	Active Motion	-	-
	Passive Motion	In normal range	In normal range
	Atrophy	**+**	**+**
	Length(cm)	49	48
	Muscle Shortness	-	-

musculoskeletal assessment of patient, active movement wasn't observed in the patient's upper and lower joints, passive range of motions were in the normal range of and muscle atrophy were determined in all the upper and lower extremities. It was found that left side upper and lower limbs were shorter than right side. However it was determined that lumbar extensors, lower extremity hip flexors, adductors, internal rotators, hamstrings group muscles of lower extremity and shoulder flexors, adductors and internal rotator muscles of the upper extremity were not shortness.

In conclusion; to prevent the secondary deformities in CD, we believe that it is important to create a physiotherapy program aimed including correct positioning for 24 hours and the symmetric loading to the musculoskeletal system. For these family should be part of treatment team.

Conflict of interest

The authors declare no conflict of interest.

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