



# TREATMENT OF THE SPASTICITY IN CHILDREN WITH CEREBRAL PALSY

AJŠA MEHOLJIĆ-FETAHOVIĆ\*

Pediatric Clinic, University of Sarajevo Clinics Centre,  
Bolnička 25, 71 000 Sarajevo, Bosnia and Herzegovina

\* Corresponding author

## ABSTRACT

Botulinum toxin is a natural purified protein and one of the strongest biological poisons – neurotoxin. It is produced by the bacterium *Clostridium botulinum*. Its medical usage started in USA in 1981 and in Europe in 1992. There are seven different immune types of the toxin: A, B, C1, D, E, F and G. Toxin types A and B are used to decrease muscular spasticity. Botulinum toxin prevents the formation of acetylcholine from cholinergic nerve tissues in muscles, which in the end irreversibly destroys neuromuscular synapses. It is called temporary local chemodenervation. It does not affect the synthesis of acetylcholine.

As it affects neuromuscular bond it also affects one of the symptoms of cerebral palsy - spasticity. Decreasing the spasticity of children with cerebral palsy leads to the improvement of conscious movements, muscles are less toned, passive mobility is improved, orthosis tolerance is also improved, and the child is enabled to perform easier and better motor functions such as crawling, standing and walking. Since the action of Botulinum toxin is limited to 2-6 months, new neural collaterals are formed and neuromuscular conductivity is reestablished which in the end once again develops a muscular spasm. This leads to a conclusion that botulinum toxin should again be applied into spastic muscles.

It is very important for good effect of Botulinum toxin to set the goals of the therapy in advance. The goals include improvement of a function, prevention of contractions and deformities, ease of care and decrease of pain for children with cerebral palsy. After application of botulinum toxin, it is necessary to perform adequate and intensive physical treatment with regular monitoring of effects.

This work shows a case of a boy with spastic form of cerebral palsy. After being habilitated using Vojta therapy and Bobath concept and the conduct of certain physical procedures, botulinum toxin is administered into his lower limbs' muscles and kinezitherapy intensified. After the administration of botulinum toxin significant functional improvement is noted.

KEY WORDS: Botulinum toxin, cerebral palsy, spasticity, treatment

## INTRODUCTION

Cerebral palsy represents a set of symptoms that developed as a result of abnormal brain development or brain damage during intrauterine development, labor or at an early stage of post delivery period. It is the most common reason of severe handicap in childhood (1,2).

A particular form of cerebral palsy depends on the location and severity of a brain damage. Due to a damage of the upper motor neuron and the resulting absence of inhibitory influence of higher centers, the development of the child is disturbed. A pathologically increased muscle tonus is usually present along with a development of pathological forms of posture and movement, decreased ability to conduct directional wishful movements, fine motor coordination, balancing and walk. Symptoms are different with every child. In addition to motor difficulties children with cerebral palsy also have difficulties in the development of mental functions, speech, hearing, sight, perception, swallowing, sphincter control, learning, epilepsy and other (3).

Conducted therapeutic measures can influence the development and the severity of cerebral palsy. In early stages early habilitation is very important as is also the preparation of a child to lead its everyday activities. As the child grows, depending on its needs, we administer different medicaments, rehabilitation devices, and conduct surgical treatments. The choice depends on the child's age, form of cerebral palsy, grown disabilities, possibilities of improvement of functional status as well as the social situation (4,5).

Most often, larger number of therapies is combined, as this kind of approach gives the best results. It is necessary for each child to choose an individual therapy that suits it best in a given moment.

As a result of damage of an upper motor neuron and due to the absence of inhibitory influence of higher centers, spasticity or highly increased muscle tonus is observed with children with cerebral palsy. Raised level of muscle tonus inevitably means increased reflexes to extensions. We treat muscle spasticity if it disturbs the function, causes deformations and negatively influences the ability and quality of a child's life. For this purpose we use Botulinum toxin. Before its application it is necessary that a multidisciplinary team, that has experience in habilitation of children with cerebral palsy, conducts an analysis of a child's ability (6,7).

Main indication to use Botulinum toxin is a locally increased muscle tonus with unwished movements. Thus Botulinum toxin is recommended for treatment of:

- a) Dynamic equines of a walking foot
- b) Dynamic knee flexor decrease resulting in a flexed walk as well as a flexed knee while laying
- c) Scissor walking
- d) Decrease of a thumb's abduction into the palm
- e) Improvement of a hand's position in a radio carpal joint and elbow (8).

Contraindications for Botulinum toxin application are:

- a) Presence of strong contractures
- b) Unstable joints
- c) Bone deformations
- d) Generally increased muscle tonus
- e) Hyper sensibility to components of Botulinum toxin

Side effects are rare. Symptoms similar to flu can appear - mild muscle weakness. Botulinum toxin effect can be seen 48-72 hours after application and lasts 3-6 months after which it fades. Next application is possible after 3 months (9,10).

## OBJECTIVE OF THE WORK

Botulinum toxin has been administered into the lower limbs of a boy with cerebral palsy in order to decrease his muscle spasticity and improve his functional status, after a long habilitation treatment.

## CASE STUDY

A boy Z. S. aged six. He is the second child from the second pregnancy. He has been delivered by a cesarean cut in the eight month of pregnancy due to a premature rupture of membranes. He was after birth hospitalized in Intensive care unit of the Pediatric clinic where he stayed for one month. He was dismissed with diagnosis: N. praetemporarius, Asphyxia perinatalis, Sepsis.

Due to urinary problems hospitalized at Nephrology unit for a long time.

As a part of a neuropsychiatric examination, brain MRI taken which showed hypoplastic corpus calosum with dilated ventricular system at the third and lateral level

of brain chambers without MRI sign of a periventricular dilution. After an ophthalmologic examination, convergent strabismus is diagnosed. EEG registration showed raised electro cortical epileptic activity above the front parietal regions, slight. After observation, psychologist diagnoses slowed down and disharmonic.

Due to bad overall condition of a child and frequent hospitalizations, habilitation is started when child reached 8 months of life. First habilitation treatment was done using Vojta method after which a certain improvement in motor development was seen. Vojta treatment was stopped after the child experienced epileptic attacks (a contra indication) and Bobath concept treatment is commenced.

The child develops a clinical picture of cerebral palsy with spastic tetra paresis but dominant diparesis. Results of a habilitation treatment are noticed in child's ability to now turn from lying on back to lying on belly and vice versa. At age of two it can bring itself to a sitting position and stay in this position. At age of two years and nine months the child crawls but pulls both legs together while crawling. At age three years and six months it establishes normal crawling. For the purpose of maintaining the functional position of feet, plastic one-part night orthosis are made.

At age four years and three months the child controls kneeling position but cannot step out and stand up alone. Lower limbs muscle tonus is highly raised but there are no contractures in joints. Passive verticalization shows distinct genua valga, with tendency to balance on toes (Figure 1).



FIGURE 1. Status before applying Botulinum toxin (tense adductors that lead to genua valga knee position, very noticeable balance on left foot toes)

As there were not any functional status changes since this period till the age of six when the child was admitted at age of six, 480 (I.U.) of Botulinum toxin (Disport), derived from its body mass, was administered. After the anesthetic gel was administered, Botulinum toxin was applied into thighs' adductors and calves' muscles on the back. After this, intensive kinezitherapy was done, preceded by hydrotherapy. Gypsum holders with the length of legs were built and applied after treatment in order to keep the functional position of feet and help reach full extension in knee joints (Figure 2).



FIGURE 2. During the treatment gypsum holders are administered in order to maintain reached level of joints' movement

During treatment various devices were used out of which standing supporters took an important role (Figure 3).



FIGURE 3. During the treatment standing supporters are used to maintain standing position

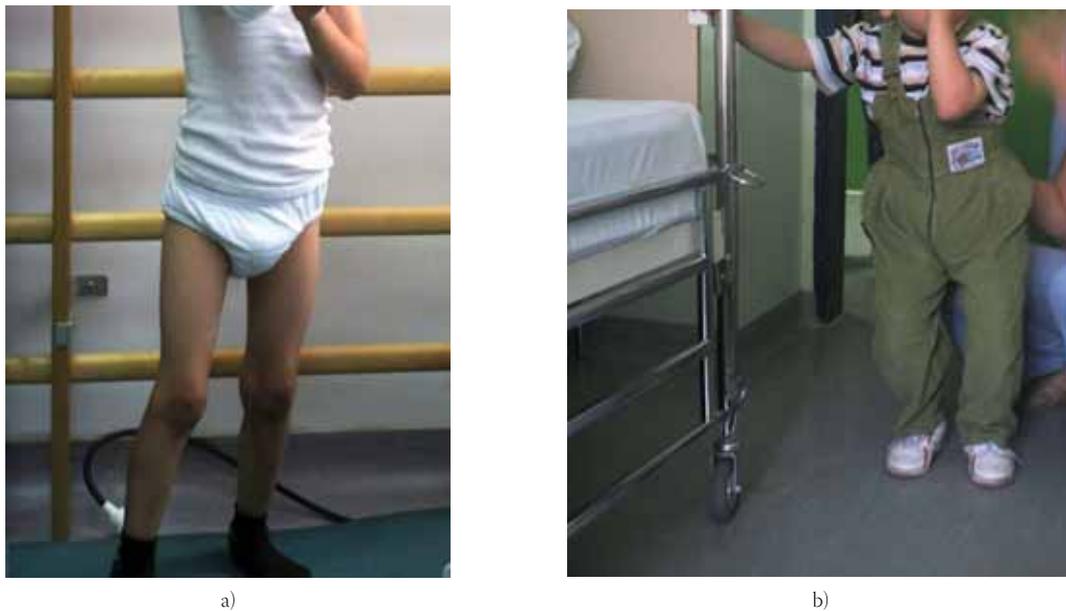


FIGURE 4. Results after applying Botulinum toxin: full feet balance, slight genua valga, the boy stands and walks assisted with one hand

Results of such a treatment were evident. Muscle tonus at lower limbs decreased a lot. Kinezitherapy treatment is performed much easier. After one month of treatment, the boy verticalizes himself, stands alone held by one hand and walks assisted by another person which holds his hand. Walking is unstable and on a wide basis. Attempts to lower his feet to the ground (Figure 4a and 4b).

## DISCUSSION

A case of a six year old boy with cerebral palsy is described. The boy is hospitalized at the Early diagnostics, habilitation and rehabilitation department of the Pediatric clinic. The boy has developed a clinical picture

of a spastic form of cerebral palsy which was treated with Vojta method and Bobath concept kinezitherapy. As stagnation in functional status was noticed we decided to apply Botulinum toxin into lower limbs' thigh adductors m. gastrocneius and m. soleus. After Botulinum toxin application functional status of the boy is significantly improved and he verticalizes himself from a kneeling position and stands alone held by one arm. Walks assisted by someone else. Research shows that children younger than 4 years of age react better to Botulinum toxin therapy than older. It is important to use this therapy before joints' and bones' deformations develop, which we have done with our patient (6,7).

## CONCLUSION

The treatment of children with cerebral palsy is complex and asks for a multidisciplinary approach. Habilitation of these children starts in their earliest life stage and the results depend on various factors. One of the most important is a pathomorphological brain substrate from which the clinical picture of the cerebral palsy depends. If the pyramid way is damaged and a clinical picture of cerebral palsy has developed, then, along with the kinezitherapy, Botulinum toxin is also used for treatment of spasticity.

Botulinum toxin application is a safe means of decreasing the spasticity and improvement of functional status of children with cerebral palsy. To reach a good effect, proper choice of the patient is needed, timely determining of therapy's goals, taking care of application recommendations, as well as the follow up kinezitherapy.

## REFERENCES

- (1) Koman L.A., et al. Botulinum toxin type A neuromuscular blockade in the treatment of equinus foot deformity in cerebral palsy: A multicenter, open-label clinical trial. *Pediatrics* 2001; 108(5): 1062–1071.
- (2) Koman L.A., et al. Cerebral palsy. *Lancet* 2004; 363:1619
- (3) Singhi P., Ray M. Botulinum toxin in children with cerebral palsy. *Indian. J. Pediatr.* 2004; 71:1087-1091
- (4) Edward M., Goldstein M.D., Safety of high-dose botulinum toxin type A therapy for the treatment of pediatric spasticity. *J. Child Neurol.* 2006; Vol. 21. ( 3): 189-193
- (5) Sanger T.D. Botulinum toxin type B improves the speed of reaching in children with cerebral palsy and arm dystonia: an open-label, dose-escalation pilot study. *J. Child Neurol.* 2007; Vol. 22. (1): 116-122
- (6) Park E.S. The effect of botulinum toxin type A injection into the gastrocnemius muscle on sit-to-stand transfer in children with spastic diplegic cerebral palsy, *Clinical Rehabilitation*, 2006; 20. (8): 668-674
- (7) Davies L.E. Botulinum toxin: from poison to medicine. *Western J. Med.* 1993; 158: 25-29
- (8) Ubhi T., Bhakta B.B., Ives H.L., Allgar V., Roussounis S.H., Randomized double blind placebo controlled trial of the effect of botulinum toxin on walking in cerebral palsy. *Arch. Dis. Child.* 2000; 83: 481-487.
- (9) Naumann M., Jankovic J. Safety of Botulinum toxin type A: A systematic review and meta-analysis. *Curr. Med Res. Opin.* 2004; 20: 981-990.
- (10) Houltram J., Noble I., Boyd R.N., et al. Botulinum toxin type A in the management of equinus in children with cerebral palsy: an evidence-based economic evaluation. *Eur. J. Neurol.* 2001; 8 (Suppl. 5): 194-202.