doi: 10.7499/j.issn.1008-8830.2016.02.006

Article‧Clinical Research

Effect of botulinum toxin A injection in the treatment of gastrocnemius spasticity in children aged 9-36 months with cerebral palsy: a prospective study

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**Abstract: Objective** To investigate the long-term clinical efficacy and adverse effects of botulinum toxin-A (BTX-A) injection in the treatment of gastrocnemius spasticity in children aged 9-36 months with cerebral palsy. **Methods** Eighty children aged 9-36 months with cerebral palsy and gastrocnemius spasticity were selected and randomly divided into a BTX-A injection group and a conventional treatment group (*n* = 40 each). The children in the BTX-A injection group received injections of BTX-A guided by color Doppler ultrasound and 4 courses of rehabilitation training after injection. Those in the conventional treatment group received 4 courses of the same rehabilitation training alone. Before treatment and at 1, 2, 3, and 6 months after treatment, the modified Tardieu scale (MTS) was applied to assess the degree of gastrocnemius spasticity, the values in the passive state measured by surface electromyography (sEMG) were applied to evaluate muscle tension, and the Gross Motor Function Measure (GMFM) was used to evaluate gross motor function. **Results** Compared with the conventional treatment group, the BTX-A injection group had significantly greater reductions in MTS score and the values in the passive state measured by sEMG (*P* < 0.05). No serious adverse reactions related to BTX-A injection were found. **Conclusions** BTX-A injection is effective and safe in the treatment of gastrocnemius spasticity in children aged 9-36 months with cerebral palsy.

**Key words:** Botulinum toxin A; Gastrocnemius spasticity; Ultrasound; Cerebral palsy; Child

**[Date received]** 2015-10-22; **[Dated accepted]** 2015-12-16

**[Project funding]** Zhengzhou Municipal Bureau of Science and Technology General Key Scientific and Technological Project (2015) (153PKJGG164)

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 In 1993, Koman et al.[1] first reported on the treatment of spasticity with botulinum toxin A (BTX-A) injection in children with cerebral palsy. Although BTX-A is a neurotoxin, because of its efficacy in the relief of spasm, it has been widely used in clinical practice, especially in the treatment of spasm in children with cerebral palsy[2]. While reporting on its effectiveness, many studies have demonstrated the safety of BTX-A injection[3-4]. However, currently BTX-A injection is used mainly in the treatment of muscle spasm in preschool and school-age children with cerebral palsy in China. This is perhaps due to the consideration that the blood-brain barrier is incomplete in infants and young children, that BTX-A injection can cause adverse reactions and possibly adverse effects on muscle development and structure, and that the efficacy of early rehabilitation therapy on relieving spasms is relatively good. Nevertheless, infants and young children are in the early stage of motor function development and therefore particularly in need of interventional treatment for spasms. In cerebral palsy children with high muscle tension, spasticity can interfere with the physiological balance mechanism of muscle, affecting the development of motor function, especially standing and walking function. Thus, if early treatment of spasticity using BTX-A injections can achieve better long-term efficacy with no serious adverse events, it will be of important clinical value for the rehabilitation of cerebral palsy. Equinus is a common condition in children with cerebral palsy and is mainly caused by triceps surae spasticity, which, if not relieved early, can cause Achilles tendon contracture and deformity. BTX-A injection in the soleus muscle can easily lead to ankle joint instability, thereby affecting the balance function in children. For this reason, the gastrocnemius muscle was selected as the target muscle for BTX-A injection. For the superficial and large gastrocnemius muscle, the localization method of freehand “reverse direction-stretching” is conventionally used for BTX-A injection. However, considering that the children are in a crying and tense state, the freehand “reverse direction-stretching” localization method can easily lead to movement of the positioned muscle or overly deep injection. This can cause some BTX-A to be injected into adjacent non-target muscles, thereby reducing the clinical efficacy and indirectly causing weakness of the non-target muscles. The present study used the more accurate ultrasound localization method, which enabled constant monitoring of the injection process to effectively avoid injection errors, alleviate pain in children, and improve clinical efficacy. This study aims to investigate the long-term clinical efficacy and adverse reactions of ultrasound-guided BTX-A injection in the treatment of gastrocnemius spasticity in the lower limbs of children aged 9-36 months with cerebral palsy.

1. **Materials and Methods**
	1. **Study subjects**

The study subjects were 80 children with spastic cerebral palsy who received therapy at the Department of Children's Rehabilitation, Third Affiliated Hospital of Zhengzhou University from January to December 2014. The gastrocnemius muscle of the lower limb was the target muscle. The random number table method was used to randomly divide the 80 patients into the BTX-A injection group and conventional treatment group, with 40 patients in each group. The BTX-A injection group received 4 courses of rehabilitation training after BTX-A injection. The conventional treatment group only received 4 courses of the same rehabilitation training. Comparison of baseline data including sex, age, and condition showed no significant differences between the two groups of children (Table 1).

Inclusion criteria: (1) met the diagnostic criteria for pediatric spastic cerebral palsy of the Ninth National Conference on Cerebral Palsy Rehabilitation in Children[5]; (2) aged 9 to 36 months; (3) classified as Level II-IV on the Gross Motor Function Classification System (GMFCS); (4) R2 - R1 ≥ 10° on spasticity assessment on the modified Tardieu Scale (MTS); (5) had not received BTX-A injection in the past six months; (6) gastrocnemius muscle spasticity, which had not been surgically treated; (7) family members agreed to receive treatment with BTX-A injection and signed informed consent.

Exclusion criteria: (1) prone to allergies, and had severe liver and kidney dysfunction; (2) presence of neuromuscular junction diseases; (3) infection at the injection sites or other sites of the body; (4) use of certain drugs that aggravated impairment of neuromuscular transmission in the past week; (5) presence of joint fixation, with severe contracture of the target muscle group.

This study has been approved by the Ethics Committee of the Third Affiliated Hospital of Zhengzhou University; approval number: 2015 Medical Ethics Review No. (02).

Table 1 Comparison of baseline data between the two groups of children

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Group | *n* | Sex (*n*) | Age (*x̄* ± *s*, mo) | Type (*n*) |
| Male | Female | Diplegia | Hemiplegia | Quadriplegia |
| Conventional treatment group | 40 | 32 | 8 | 20 ± 5 | 21 | 8 | 11 |
| BTX-A injection group | 40 | 28 | 12 | 20 ± 5 | 21 | 9 | 10 |
| *χ*2(*t*) |  | 1.07 | (-0.03) |  | 0.11 |  |
| *P* |  | 0.30 | 0.98 |  | 0.95 |  |

* 1. **Ultrasound-guided BTX-A injection**

Powder for BTX-A injection, Botox (Allergan USA, Inc.), was used, with each vial containing 100 IU of BTX-A and stored in the dark at 2-8 ℃. The injection dose was 3 IU/kg for each target muscle, with a total dose of < 20 IU/kg or < 400 IU for the whole body. The powder was diluted with 2 mL of normal saline to 50 IU/mL prior to use. During injection, GE Logiq P5 color Doppler ultrasound machine was used for localization. The children were in a prone position, and the injection site was disinfected with Anerdian. The inejctor wore sterile gloves. The ultrasound operator placed the probe over the muscle belly based on the anatomical location of the gastrocnemius muscle, using the center position between the vertical and horizontal axes of the probe to position the muscle belly of the medial and lateral head, which was indicated with a marker pen. The injector used the left hand to stabilize the skin at the injection site, and used the right hand to hold the syringe to insert the needle perpendicularly into the marked site, fix the probe to measure the distance from the skin to the target muscle belly, and inject BTX-A once the needle had been inserted into the center position of the target muscle belly. The medial and lateral head of gastrocnemius muscle were each injected at two points, with a distance of > 2 cm between points. The maximum dose for each injection site was 20 IU and total dose for each target muscle was < 50 IU each time. Instructions were given to keep the injection site clean to prevent infection, to rest in bed for 24 h, and to cooperate with rehabilitation training after 24 hr.

* 1. **Rehabilitation training**

Rehabilitation training included: (1) the Bobath therapy was used, using techniques such as passive movement to reduce muscle tension, stretching the ankle joint to increase range of motion of joint, and using reflex inhibiting postures to inhibit abnormal postures, 40 min a time, 5 times a week; (2) The paraffin cake method was used for paraffin treatment at temperatures of 52-55 ℃, applying the paraffin to the gastrocnemius muscle, 30 min a time, 5 times a week; (3) neuromuscular electrical stimulation therapy was used to stimulate the antagonist of the gastrocnemius muscle, the tibialis anterior muscle, at a frequency of 1 Hz and pulse width of 100 ms, 20 min a time, 5 times a week. The above-mentioned treatments had a treatment course of 3 weeks, a course interval of 2-3 weeks, and a total of 4 courses. The above-mentioned rehabilitation training was used in the conventional treatment group. The BTX-A injection group received 4 courses of the same rehabilitation training 24 h after BTX-A injection. The actual rehabilitation training given was adjusted based on the actual condition of the children. Both groups received home rehabilitation guidance, such as Achilles tendon stretching, in-between treatment courses. In addition, training to improve muscle strength, such as squatting training and active dorsiflexion, was given based on the age and condition of the children. At the same time, guidance was given on maintenance of correct sitting and standing postures in children.

* 1. **Efficacy evaluation**

The Modified Tardieu Scale (MTS)[6] was used to assess the degree of gastrocnemius spasticity before treatment and 1, 2, 3, and 6 months after treatment. The response of the gastrocnemius muscle to stretch applied at given velocities was assessed with two parameters.

(1) Quality of muscle reaction (X): graded 0-5. Grade 0: no resistance going through the full passive range of motion; Grade 1: slight resistance going through the full passive range of motion, with no clear catch at a precise angle; Grade 2: clear catch at a precise angle, interrupting the passive movement, followed immediately by a release and successful passing of the full range of motion; Grade 3: fatigable clonus (stopping after < 10 s) occurring at a precise angle of the passive movement (when maintaining a certain force or this position); Grade 4: indefatigable clonus (lasting over 10 s) occurring at a precise angle of the passive movement (when maintaining a certain force or this position); 5. joint immovable. The MTS quality of muscle reaction grades were converted to scores: 0 point for Grade 0, 1 point for Grade 1, 2 points for Grade 2, 3 points for Grade 3, 4 points for Grade 4, and 5 points for Grade 5.

(2) Angle of muscle reaction (Y): ① R1 is the angle at which a catch or clonus occurs in the target joint during passive movement at a certain posture at V3 (stretch at a velocity faster than that occurring under gravity); ② R2 is the angle of full passive range of motion at a certain posture at V1 (at a velocity slower than that occurring under gravity), which is equivalent to the passive joint range of motion.

Values on the surface electromyography (sEMG) were measured before treatment and 1, 2, 3, and 6 months after treatment in order to compare quantitatively improvement in muscle tension in children before and after treatment. The children were in a prone position and relaxed state, with both legs extended, and electrode pads were placed on the medial and lateral head of the gastrocnemius muscle to measure values in the resting state, passive state, and active state. Because children cried and became tense easily and were less cooperative, muscle tension was assessed using values on sEMG taken when the ankle joint was passively stretched.

At the same time, the Gross Motor Function Measure (GMFM-88) was used to assess motor function in children before and after treatment.

* 1. **Statistical analysis**

The SPSS 17.0 statistical software was used for statistical analysis of the data. Count data were expressed in number of cases and *χ*2 test was used for between-group comparison. Normally-distributed measurement data were expressed in mean ± standard deviation (*x̄* ± *s*) and *t*-test was used for between-group comparison. Repeated measures analysis of variance was used to compare across multiple time points and the Greenhouse–Geisser correction test was used when the test of sphericity was not met. *P* < 0.05 was considered statistically significant.

1. **Results**
	1. **Comparison of MTS (X) scores at various time points before and after treatment between the two groups of children**

There was no significant difference in MTS (X) score before treatment between the children in the conventional treatment group and BTX-A injection group (*t* = -0.98, *P* = 0.327); the MTS (X) scores in the two groups both decreased with extension in treatment time (*F* = 52.10, *P* < 0.001). Both groups were able to reduce the grade of muscle tension. In addition, the two groups were significantly different in reduction of MTS (X) score (*F* = 5.15, *P* = 0.027). There was an interaction effect between the factor of group and MTS (X) scores before and after treatment (*F* = 15.61, *P* < 0.001) (Table 2).

Table 2 Comparison of MTS (X) scores at various time points before and after treatment between the two groups of children (*x̄* ± *s*, score)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Group | No. of limbs | Before treatment | 1 month after treatment | 2 months after treatment | 3 months after treatment | 6 months after treatment |
| Conventional treatment group | 72 | 2.2 ± 0.6  | 2.0 ± 0.7 | 1.9 ± 0.8 | 1.8 ± 0.8 | 1.8 ± 0.8 |
| BTX-A injection group | 71 | 2.3 ± 0.7 | 1.6 ± 0.9 | 1.3 ± 0.9 | 1.2 ± 1.0 | 1.1 ± 1.0 |

Note: Repeated measures analysis of variance was used to compare MTS (X) scores at various time points before and after treatment between the two groups of children, showing differences across time (*F* = 52.10, *P* < 0.001); differences between groups (*F* = 5.15, *P* = 0.027); and interaction effect between time and group (*F* = 15.61, *P* < 0.001).

* 1. **Comparison of MTS joint angle (R1) at various time points before and after treatment between the two groups of children**

There was no significant difference in MTS joint angle (R1) before treatment between the children in the conventional treatment group and BTX-A injection group (*t* = -1.32, *P* = 0.192); the joint angles (R1) in the two groups both increased with extension in treatment time (*F* = 81.33, *P* < 0.001). Both groups were able to increase the range of motion of joint. In addition, the two groups were significantly different in increase in MTS joint angle (R1) (*F* = 4.28, *P* = 0.043). There was an interaction effect between the factor of group and MTS joint angle (R1) before and after treatment (*F* = 21.20, *P* < 0.001) (Table 3).

Table 3 Comparison of MTS joint angle (R1) at various time points before and after treatment between the two groups of children (*x̄* ± *s*, degree)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Group | No. of limbs | Before treatment | 1 month after treatment | 2 months after treatment | 3 months after treatment | 6 months after treatment |
| Conventional treatment group | 72 | 1.3 ± 8.9  | 3.4 ± 9.0 | 5.1 ± 8.7 | 6.2 ± 8.7 | 6.9 ± 8.7 |
| BTX-A injection group | 71 | -1.5 ± 8.7 | 6.5 ± 8.7 | 11.9 ± 13.3 | 11.5 ± 8.1 | 15.9 ± 8.0 |

Note: Repeated measures analysis of variance was used to compare MTS joint angle (R1) at various time points before and after treatment between the two groups of children, showing differences across time (*F* = 84.33, *P* < 0.001); differences between groups (*F* = 4.28, *P* = 0.043); and interaction effect between time and group (*F* = 21.20, *P* < 0.001).

* 1. **Comparison of MTS joint angle (R2) at various time points before and after treatment between the two groups of children**

There was no significant difference in MTS joint angle (R2) before treatment between the children in the conventional treatment group and BTX-A injection group (*t* = -1.20, *P* = 0.233); the joint angles (R2) in the two groups both increased with extension in treatment time (*F* = 274.99, *P* < 0.001). Both groups were able to increase the range of motion of joint. In addition, the two groups were significantly different in increase in MTS joint angle (R2) (*F* = 4.02, *P* = 0.049). There was an interaction effect between the factor of group and MTS joint angle (R2) before and after treatment (*F* = 61.28, *P* < 0.001) (Table 4).

Table 4 Comparison of MTS joint angle (R2) at various time points before and after treatment between the two groups of children (*x̄* ± *s*, degree)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Group | No. of limbs | Before treatment | 1 month after treatment | 2 months after treatment | 3 months after treatment | 6 months after treatment |
| Conventional treatment group | 72 | 11.7 ± 8.9 | 13.4 ± 8.2 | 15.6 ± 7.6 | 16.2 ± 7.5 | 16.8 ± 7.7 |
| BTX-A injection group | 71 | 9.1 ± 9.1 | 18.1 ± 7.6 | 20.6 ± 6.3 | 21.8 ± 5.6 | 22.1 ± 5.7 |

Note: Repeated measures analysis of variance was used to compare MTS joint angle (R2) at various time points before and after treatment between the two groups of children, showing differences across time (*F* = 274.99, *P* < 0.001); differences between groups (*F* = 4.02, *P* = 0.049); and interaction effect between time and group (*F* = 61.28, *P* < 0.001).

* 1. **Comparison of passive state value on sEMG at various time points before and after treatment between the two groups of children**

There was no significant difference in value taken in the passive state on sEMG before treatment between the children in the conventional treatment group and BTX-A injection group (*t* = 0.73, *P* = 0.470); the values in the passive state on sEMG in the two groups both decreased with extension in treatment time (*F* = 295.35, *P* < 0.001). A gastrocnemius muscle-tension lowering effect was seen in both groups. In addition, the two groups were significantly different in reduction of values in the passive state on sEMG (*F* = 6.27, *P* = 0.015). There was an interaction effect between the factor of group and value in the passive state on sEMG before and after treatment (*F* = 19.60, *P* < 0.001) (Table 5).

Table 5 Comparison of sEMG values at various time points before and after treatment between the two groups of children (*x̄* ± *s*, μV)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Group | No. of limbs | Before treatment | 1 month after treatment | 2 months after treatment | 3 months after treatment | 6 months after treatment |
| Conventional treatment group | 72 | 30 ± 7 | 26 ± 5 | 23 ± 5 | 21 ± 5 | 21 ± 5 |
| BTX-A injection group | 71 | 32 ± 6 | 22 ± 4 | 19 ± 7 | 17 ± 7 | 17 ± 5 |

Note: Repeated measures analysis of variance was used to compare sEMG values at various time points before and after treatment between the two groups of children, showing differences across time (*F* = 295.35, *P* < 0.001); differences between groups (*F* = 6.27, *P* = 0.015); and interaction effect between time and group (*F* = 19.60, *P* < 0.001).

* 1. **Comparison of GMFM scores at various time points before and after treatment between the two groups of children**

There was no significant difference in GMFM score before treatment between the children in the conventional treatment group and BTX-A injection group (*t* = 012, *P* = 0.908); the GMFM scores in the two groups both increased with extension in treatment time (*F* = 296.47, *P* < 0.001). There was significant improvement in gross motor function in both groups. In addition, the two groups were significantly different in improvement of GMFM score (*F* = 6.73, *P* = 0.013). There was an interaction effect between the factor of group and GMFM score before and after treatment (*F* = 40.26, *P* < 0.001) (Table 6).

Table 6 Comparison of GMFM scores at various time points before and after treatment between the two groups of children (*x̄* ± *s*, score)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Group | No. of limbs | Before treatment | 1 month after treatment | 2 months after treatment | 3 months after treatment | 6 months after treatment |
| Conventional treatment group | 40 | 44 ± 12 | 45 ± 12 | 47 ± 10 | 51 ± 9 | 59 ± 9 |
| BTX-A injection group | 40 | 44 ± 15 | 52 ± 13 | 56 ± 12 | 69 ± 12 | 71 ± 11 |

Note: Repeated measures analysis of variance was used to compare GMFM scores at various time points before and after treatment between the two groups of children, showing differences across time (*F* = 296.47, *P* < 0.001); differences between groups (*F* = 6.73, *P* = 0.013); and interaction effect between time and group (*F* = 40.26, *P* < 0.001).

* 1. **Adverse reactions**

Main adverse reactions following BTX-A injection were: crying in 25 children, which stopped after persisting for 2-3 h. This is considered to be caused by pain at the injection site; 33 children had decreased muscle strength, which generally recovered after 2- 4 weeks of treatment, with the longest muscle recovery time being 2 months in 1 child; 1 child presented with red, spotted rash on 4 limbs 18 h after BTX-A injection, with no other accompanying symptoms. The rash disappeared after 3 d with no treatment and was considered to be a possible skin allergy.

1. **Discussion**

Cerebral palsy is characterized by persistent movement disorders and abnormal postures, which may be accompanied by other problems including disturbances of sensation and perception and secondary muscle spasticity. Lower limb spasticity in children with cerebral palsy often leads to abnormal postures, poor standing balance, and decline in the ability to walk independently. BTX-A injection is an important treatment method for relieving spasms in children with cerebral palsy. In terms of the safety of its injection in infants and young children, studies have reported that its adverse reactions were all mild and self-limited[4,7-8]. The study by Tedroff et al.[4] on BTX-A injection in children under 2 years of age with cerebral palsy found some minor adverse reactions only. Zonta et al.[9] performed BTX-A injection on 24 hemiplegic children (aged 6 to 15 months) who were followed up for 36.63 months and found that early BTX-A injection had no adverse effects on the development of the injected muscle. In the present study, the 40 children with cerebral palsy had no serious adverse reactions after receiving BTX-A injection. The most common adverse reactions were transient pain at the injection site and transient decrease in muscle strength. Therefore, BTX-A injection in infants and young children with cerebral palsy is safe at an appropriate dose when taking into account the location and degree of the spasticity and the weight of children. When motor development disorders are present in children with cerebral palsy, comprehensive rehabilitation therapy is often given. In addition, much literature has confirmed the efficacy of BTX-A injection in relieving spasms in children with cerebral palsy. The results of this study showed that muscle tension grade decreased after treatment in the two groups of children. The BTX-A injection group was better than the conventional treatment group in terms of reduction in MTS (X) score, suggesting that BTX-A injection has a significant effect in reducing gastrocnemius muscle tension. Tedroff et al.[4] randomly divided children under two years of age (mean age of 16 months) with cerebral palsy into the BTX-A injection group and conventional treatment group, who were followed up at 1 year and 3.5 years, and found that children in the injection group were better than those in the conventional treatment group in terms of gastrocnemius muscle tone decrease and ankle joint range of motion. The European Consensus 2009 on the use of Botulinum toxin for children with cerebral palsy[10] pointed out that the younger the children, the better the efficacy. Thus, early BTX-A injection combined with rehabilitation therapy is better than rehabilitation therapy alone at reducing muscle spasticity and preventing joint contractures in children with cerebral palsy. Although reliability and validity studies have not been conclusive on MTS, compared with the Modified Ashworth Scale, the MTS has higher reliability and sensitivity in the assessment of spasticity because it incorporates muscle's response to stretch at different velocities including fast and slow[11-13]. As can be seen from the results of this study, the MTS score did not decline substantially in the BTX-A injection group. This may be caused by the relatively large gap between Grade 2 and Grade 3 of the MTS leading to poor sensitivity for change in muscle spasms not accompanied by clonus. This suggests that the MTS is acceptable for the assessment of gastrocnemius spasticity, but is of relatively small value for non-clonic muscle spasms such as those in the hamstring muscle group. The present study used the MTS R1 and R2 assessment to take into account the resistance of the muscle when responding to passive stretch at both slow and fast speed, which takes better account of the velocity-dependent properties of spasticity. At the same time, the difference between R1 and R2 was obtained at the different velocities, V1 and V3, reflecting velocity-dependent resistance to stretch. The larger the difference, the larger the dynamic component of spasticity and the smaller the component of contracture, indicating a greater room for improvement and good efficacy of BTX-A injection[14].

sEMG magnifies, displays, and records bioelectric signals during the activity of the neuromuscular system from the surface of the skin with the guidance of electrodes. It is related with varying degrees to the active state and functional state of the muscle. The collected data reflect the degree of spasticity to a certain extent, reducing errors in the subjective evaluation of testers, showing high repeatability, and enabling accurate quantitative comparison of muscle tension improvement in children before and after treatment. Because the relatively young age of the children enrolled in this study could lead to poor assessment of muscle tension during active contraction while the children attempted to be in a relaxed state, this study used values on sEMG taken in the state of passive stretch to better reflect the actual muscle tension in children. This study showed that gastrocnemius muscle tension decreased in both groups of children after treatment, and that the BTX-A injection group was better than the conventional treatment group in terms of reduction in sEMG values. Bar-On et al.[15] performed BTX-A injection in the hamstring muscle group in 19 children with spastic cerebral palsy and found that there were statistically significant differences in sEMG values before and after BTX-A injection (43 ± 16 d), concluding that sEMG is a sensitive indicator of muscle tension after BTX-A injection. The results of the present study are similar. van den Noort et al.[16] assessed gastrocnemius, hamstring, and adductor spasticity during stretch at various velocities using sEMG in 20 children with cerebral palsy. sEMG values had very reliable assessment of muscle tension in the different muscle groups at fast stretch. Thus, values taken in the passive state on sEMG have certain significance for assessment of spasticity before and after BTX-A injection. It is worth noting that sEMG examination of younger children should be performed by a single person and as far as possible performed while the children are in a relaxed state in order to avoid discrepancy between sEMG values and actual muscle tension caused by stress and crying in children.

While reducing spasticity of the target muscle using early BTX-A injection in children with cerebral palsy, abnormal postures in children can be improved and motor function development enhanced, promoting the establishment of motor function milestones from crawling to walking in children. In addition, a large number of domestic and international studies have confirmed that BTX-A injection can promote motor development in children with spastic cerebral palsy[17-19]. Zhou et al.[20] performed BTX-A injection in the triceps muscle of 27 cerebral palsy children with equinus deformity and found that GMFM scores increased after 2 weeks, 1 month, 3 months, and 6 months of treatment. The differences as compared to before treatment were statistically significant. The results of this study are consistent: GMFM scores increased with extension in treatment time in children after treatment with BTX-A injection, which was better than conventional treatment in terms of improving GMFM score. While reducing gastrocnemius spasticity with BTX-A injection and improving standing and walking ability, this study performed BTX-A injection in the adductor and hamstring muscles of some children with crossover gait and crouch gait. Multi-site injection of BTX-A may have a synergistic effect on improving motor function in children.

In short, ultrasound-guided injection of BTX-A combined with rehabilitation training can significantly reduce lower limb gastrocnemius spasticity in children aged 9 to 36 months with cerebral palsy, promote gross motor development of children with cerebral palsy, reduce or prevent abnormal postures, and prevent joint deformities. It is more effective than rehabilitation training alone, with fewer adverse reactions and higher safety. Ultrasound-guided injection of BTX-A is accurate in positioning, enables monitoring of the injection process to avoid injection errors and damage to surrounding muscles, glands, nerves, and blood vessels. It is a therapeutic method worthy to be promoted.

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[Article editor: LIU Fangming]

‧News‧

Notice of the Neonate - An International Symposium for Asia

“The Neonate: an international symposium for Asia" hosted by the Children's Hospital of Fudan University will be held at the Hilton Shanghai Hongqiao Hotel from March 30 to April 1, 2016. The chairpersons of the Symposium are Prof. SUN Bo (Children’s Hospital of Fudan University) and Prof. Christian P Speer (Wurzburg University Children's Hospital). The Symposium will invite Henry Halliday (United Kingdom), Ola D Saugstad (Norway), Lex Doyle (Australia), Maximo Vento (Spain), Alan Jobe (USA), Eduardo Bancalari (USA), Richard Martin (USA), Rangasamy Ramanathan (USA), and well-known clinical experts and professors from countries and regions of Asia to communicate and discuss key issues in neonatal-perinatal medicine, including the fields of resuscitation, preterm children, respiration, infection, nutrition, brain and nerves, development of preterm children, and follow-up. The aim of this Symposium is to strengthen international exchanges and cooperation between China and developed countries and developing Asian countries to promote the development of clinical neonatal medicine in China.

The Symposium has contracted the Shanghai Healife Group as the professional conference organizer who will organize the registration and conference affairs related to this Symposium. For Symposium details, programme, and registration fees and method, please enquire by visiting www.theneonate2016.org (international English site) or www.theneonate2016.com (Chinese site).

Symposium methods of exchange: Plenary Sessions, workshops, courses, and satellite meetings. The Symposium has set up independent submission for Poster and Post Discussion. Please visit the web page for submission guidelines. The deadline for submission is February 15, 2016. Official notification of acceptance to participate in the Symposium will be sent out on March 1, 2016.

The hosting and contract organizations welcome relevant pharmaceutical and medical device companies, trading companies, and advisory bodies to sponsor this Symposium. The Symposium will provide quality services to facilitate access to new technologies and products for professional participants. For further information about the Symposium and submission information, please contact the Symposium academic secretary Dr. QIAN Liling (Children’s Hospital of Fudan University; llqian@126.com) or the Symposium affairs secretary WU Miao (Healife; maggiewu@healife.com).

Children’s Hospital of Fudan University

December 15, 2015