

Botulinum Toxin for the Treatment of Nystagmus Associated with Exotropia

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Abstract

Purpose: Nystagmus can severely impact the visual function, lifestyle and quality of life of patients. Patient with Nystagmus may assume an abnormal compensatory head position and it can result in posture disorders. Botulinum toxin is an important treatment for much pathology of the eye, in particular for blepharospasm, strabismus and nystagmus. The mechanism of action is to prevent release of acetylcholine in the neuromuscular junction getting the neuromuscular blockade and transient flaccid paralysis. The objective of this work is to evaluate the efficacy of botulinum toxin injection in patients with Nystagmus. **Methods:** *n.* 6 patients, (3 females and 3 males) aged 17 - 35 years, exhibiting exotropia (XT) associated with Nystagmus received an injection of Botulinum Toxin A Dysport (Ipsen) in the Lateral Muscles of each eye with a 27-gauge retrobulbar needle. Patients underwent an orthoptic and ophthalmic eye exam before and after surgery. **Results:** A significant reduction of the nystagmus in primary position was reported in all patients; the abnormal position of the head was noticeably reduced. Side-effects were limited and well tolerated by the patients. **Conclusion:** Botulinum toxin injection is a valuable treatment of Nystagmus associated with exotropia.

Keywords

Nystagmus, Botulinum Toxin, Exotropia, Strabismus

1. Introduction

Nystagmus is a condition of involuntary eye movements that often results in reduction of visual acuity and abnormal head position that the patient assumes to block nystagmus shocks and increase visual acuity. Abnormal compensatory head position can result in posture disorders. Nystagmus can severely impact the visual function, the lifestyle and quality of life of patients.

There are many types of nystagmus and many classifications, but in summary nystagmus may be congenital or acquired. In congenital nystagmus, the onset occurs during first three months of life and it may be associated with several conditions such as: albinism, hypoplasia or optic sub-atrophy, congenital cataract. Acquired nystagmus can occur at any age and it results from: lesions of the midbrain, head trauma, brain tumour, serious metabolic disorders, central nervous system disorders, side-effects of drugs.

Botulinum toxin is an important treatment for much pathology of the eye in particular for blepharospasm, strabismus and nystagmus. It is a neurotoxin produced by an aerobic bacteria gram+ *Clostridium botulinum* and its mechanism of action is to prevent release of acetylcholine in the neuromuscular junction getting the neuromuscular blockade and transient flaccid paralysis. In 1992 Leigh *et coll* injected toxin into the horizontal rectus muscles of the right eyes of two patients who had acquired pendular nystagmus with horizontal, vertical, and torsional components. This treatment successfully abolished the horizontal component of the nystagmus in the injected eye in both patients for approximately 2 months [1].

Nystagmus treatment with botulinum toxin injection in extraocular muscles was also reported in other studies [2] [3] [4] [5] [6].

The aim of this study is to demonstrate the usefulness of treatment with botulinum toxin injection in patients with nystagmus associated with exotropia. Compared to previous studies, in this case it was decided to observe only patients with nystagmus associated with exotropia and to follow them over time to verify the stability of the results obtained. The reduction of the nystagmus due to botulinum toxin injection is associated with the subsequent improvement in head position, posture and quality of life.

2. Materials and Methods

From January 2017 to January 2020, a sample of 6 patients, 3 females and 3 males, aged 17 - 35 years, who exhibited exotropia (XT) associated with Nystagmus, were screened and selected for this study. The patients were examined at the "San Salvatore" hospital located in L'Aquila, Italy. The sample of patients appears to be small due to the number of patients who met the inclusion and exclusion criteria from the study observed at our clinics.

Inclusion criteria were: nystagmus associated with exotropia with no resting position but with an active blockage of nystagmus that resulted in an abnormal position of the head, on a horizontal, vertical or oblique plane.

Exclusion criteria were: nystagmus with resting position on the vertical plane, in convergence or oblique; nystagmus associated with esotropia, hypo/hypertropia, cyclotropia; nystagmus without presenting strabismus.

Patients received an injection of botulinum toxin dysport (Ipsen) in the lateral muscles of each eye, with a 27-gauge retrobulbar needle: 20 U for injection. Following negative aspiration of blood, the botulinum toxin was injected. Patients

were medicated with eyedrops, a combination of Chloramphenicol 5 mg/ml and Dexamethasone 2 mg/ml Bausch & Lomb, 3 times daily for 7 days. Follow-ups were at 14, 30 and 120 days from the injection.

Patients underwent an orthoptic and ophthalmic eye exam before and after surgery and at each follow-up. The orthoptic and ophthalmic exams included deviation angle measured with prism cover test, visual acuity, and observation with slit lamp. To evaluate the effectiveness of botulinum injection, the angle of deviation for near and far, before and after surgery, was examined.

In addition, the mean deviation of the results obtained was calculated. **Tables 1-3** show the preoperative data, the post-operative data, and the mean of the results.

3. Results

Results on average were visible after 8 days from the injection.

4. Discussion

Table 1 and **Table 3** compare the angle of deviation for near and far measured with the prism cover test before and after the injection of botulinum toxin.

As reported in **Table 3**, the post-operative mean exotropic deviation (by the prism cover test) was 6.6 prism diopters at near and 4.3 prism diopters at far. In 4 cases the deviation shifted from a Tropia to a Tropia-Phoria with the possibility of an alignment in the primary position. The mean visual acuity was 0.475 logMar. In 2 patients visual acuity had a less significant increase: in the patient with albinism, it increased from 1 to 0.7 logMar; in the patient with a serious

Table 1. Shows the pre-op values. The deviation angle for near and distance was measured with the prism cover test: mean deviation at near was 15 prism diopters, mean deviation at distance was 12.3 prism diopters, and best corrected visual acuity was 0.75 logMar.

	Sex	Age	Nystagmus with:	Angle for near	Angle for distance	Visual Acuity logMar
I. M.	F	23 y	Albinism	XT 12Δ	XT 4Δ	RE 1 LE 1
F. F.	M	25 y	Optic subatrophy	XT 16Δ	XT 12Δ	RE 0.9 LE 1
P. M.	F	17 y	Congenital	XT 14Δ	XT 12Δ	RE 0.3 LE 0.6
A. S.	M	35 y	Congenital	XT 14Δ	XT 14Δ	RE 0.3 LE 0.4
A. E.	F	32 y	Optic subatrophy	XT 20Δ	XT 18Δ	RE 1 LE 1.2
B. G.	M	28 y	Congenital cataract	XT 14Δ	XT 14Δ	RE 0.7 LE 0.6

Table 2. Compares data before and after injection. A significant reduction of the nystagmus in primary position was reported in all patients and the abnormal position of the head was noticeably reduced, where the resting position was shifted to primary position.

	Angle for near Pre	Angle for distance Pre	Angle for near Post	Angle for distance Post	VA logMar Pre	VA logMar Post
I. M.	XT 12Δ	XT 4Δ	ExoPhoria 4Δ	ExoPhoria 2Δ	RE 1 LE 1	RE 0.7 LE 0.7
F. F.	XT 16Δ	XT 12Δ	XT 8Δ	XT 4Δ	RE 0.9 LE 1	RE 0.5 LE 0.6
P. M.	XT 14Δ	XT 12Δ	ExoPhoriaTropia 8Δ	ExoPhoriaTropia 6Δ	RE 0.3 LE 0.6	RE 0.1 LE 0.2
A. S.	XT 14Δ	XT 14Δ	Exophoria 6Δ	Exophoria 4Δ	RE 0.3 LE 0.4	RE 0.1 0.2
A. E.	XT 20Δ	XT 18Δ	XT 6Δ	XT 6Δ	RE 1 LE 1.2	RE 0.9 LE 1
B. G.	XT 14Δ	XT 14Δ	ExoPhoria 8Δ	ExoPhoria 4Δ	RE 0.7 LE 0.6	RE 0.4 LE 0.3

Table 3. Compares the pre-operative and post-operative mean angle for near, mean angle for distance, and mean visual acuity.

Pre-op mean angle for near	Post-op mean angle for near	Pre-op mean angle for distance	Post-op mean angle for distance	Pre-op mean Visual Acuity (logMar)	Post-op mean Visual Acuity (logMar)
15Δ	6.6Δ	12.3Δ	4.3Δ	0.75	0.475

optic sub-atrophy, visual acuity increased from 1 (RE) and 1.2 (LE) to 0.9 (RE) and 1 (LE) logMar.

Side-effects

After the injection of botulinum toxin were observed as side effects one case of temporary palpebral ptosis that spontaneously resolved in 10 days (16.6%), and one case of temporary vertical strabismus that spontaneously resolved in 17 days (16.6%).

Results were observed at follow-up after 14 days and remained stable until the follow-up at 120 days. The effect obtained from the treatment after the fourth month diminished gradually until the sixth month, resulting in a better situation but similar to the preoperative treatment.

After the first treatment, one patient (A. E.) did not continue the treatment, whereas the remaining 5 patients are still receiving the treatment every 6 months through the injection of botulinum toxin in the lateral muscles. Results, even after 36 months, have been consistent.

5. Conclusion

The results obtained demonstrate the efficacy of botulinum toxin treatment in

patients with nystagmus associated with exotropia. The main limitation of this study is the small sample size. However, the results are satisfying and appreciated by the patients who wished to continue the treatment (5 out of 6; 83.3%). Side-effects were limited and well tolerated by the patients. In conclusion, the botulinum toxin injection represents a quick, simple, and low-cost treatment, which can be repeated over time and does not have significant or long-lasting side effects. Further research should be conducted with a larger sample size.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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