

Botulinum Toxin-A Injection in Acute Sixth Nerve Palsy

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Abstract

Purpose: To evaluate the effect of botulinum toxin-A as an alternate to surgery in acute complete sixth nerve palsy and to shorten the recovery period.

Methods: Thirty patients with acute complete sixth nerve palsy received 1-10 units of botulinum toxin-A (Dysport) injection in the medial rectus muscle within one month from the onset of palsy. Toxin was injected directly into the muscle belly under local (25 cases) or general (5 cases) anesthesia. At the 1st, 7th, 30th, 90th, and 180th day followup, binocular field of vision, abduction and any residual deviation were measured.

Results: Patients aged between 9mo to 70yrs. 24 (80%) patients had significant improvement in abduction after 3 months and 6 (20%) had $<10^\circ$ abduction. Among treatment failures, 2 were traumatic and 2 were tumoral. Binocular diplopia free field was $>75^\circ$ in 22 (73%). 22 (73%) had no residual esotropia and other 8 patients (27%) had $10-50^\circ$ residual esotropia which required surgery. No cases of exotropia or globe perforation were encountered.

Conclusion: Injection of botulinum toxin-A is a simple and safe way of treating acute complete sixth nerve palsy eliminating the need for invasive surgical manipulation in majority of cases. It can eliminate diplopia during acute stage of palsy in the cases of spontaneous recovery.

Keywords: Botulinum Toxin, Cranial Nerve, Palsy, Paresis, Sixth Nerve

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Introduction

Sixth cranial nerve has a long tortuous course in the subarachnoid space and is vulnerable to various pathologies and palsy. A patient with sixth nerve palsy develops esotropia resulting in medial rectus contracture and fibrosis. In this situation, surgery becomes difficult and complicated.¹ However, some patients with sixth nerve palsy recover spontaneously within six months.²⁻⁴

With toxin injection to antagonist of a paralyzed muscle (i.e. medial rectus muscle in the case of lateral rectus palsy) the muscle is held in lengthened position to allow better recovery.⁵⁻⁷ It was showed that the number of sarcomers is increased if the muscle is held in a lengthened position, contracture is inhibited and faster recovery of function is expected.⁸⁻¹¹

In this study, we evaluate the outcome of

this type of treatment in acute sixth nerve palsy by injecting to medial rectus muscle during the 1st month of palsy.

Methods

A total of 30 patients with acute complete sixth nerve palsy referred to outpatient department (OPD) clinics and *Khalili* Hospital accident and emergency (A&E) ward, *Shiraz* University of Medical Sciences, *Shiraz, Iran* were selected to be enrolled in a clinical trial. Depending upon clinical findings, thorough history taking and physical examination including measurement of amount of deviation by simultaneous prism cover test were done. Any necessary para-clinical workup like brain CT scan as well as neurosurgical consultation was performed.

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Informed consent was taken from the patients or their parents after discussion about advantages and disadvantages of botulinum injection. All of the injections were performed within two weeks to one month after the onset of palsy.

The botulinum-A toxin, used was Dysport™. Each Dysport vial constitutes 500 units of toxin in the form of solid powder. Each vial was prepared with the addition of 5 cc normal saline to the vial. 0.1 cc (containing 10 units of Dysport, equivalent of 2.5 units of Botox™) was injected into the muscle. Local anesthesia with lidocaine and tetracaine drop was used in adult patients, while in the children the toxin injection was performed under Ketamine anesthesia. The surgical field was prepared, the medial rectus insertion was grasped firmly with forceps and the eye was rotated to the primary position. Then 10 units of Dysport solution was injected 5-10 mm from the medial rectus insertion, parallel to medial orbital wall, inside the bulk of muscle through a 27 gauge needle (without EMG guide). The needle was held for 5-10 seconds inside the

muscle before retrieval, to prevent leakage of Dysport to the adjacent muscles.

Each patient was visited after one day, one week, one month, 3 months and 6 months from the injection. During the follow up visits all of the patients were examined to detect any improvements in position and movement of the eye. Abduction, binocular single visual field and any residual esotropia were checked for. The results were collected and analyzed.

Results

Selected patients were 18 male and 12 female who aged 9 month to 70 years (mean: 36.9 ± 20.2 years).

Among these patients, 8 were traumatic, 8 were hypertensive, 6 were diabetic, 1 was congenital, 5 had tumor and 2 had an unknown cause. Of these patients 28 had unilateral nerve palsy and 2 were bilateral. The amount of deviation was between 30 to more than 70 prism diopter. Demographic characteristics of patients are shown in table 1.

Table 1. Demographic characteristics of patients

Age / Years	Sex	Etiology	Esotropia before injection	Esotropia after injection	Amount of abduction	Diplopia free field
0.75(9 m)	M	Trauma	≈ 45 PD	<10 PD	>70 °	-----
2	F	Congenital	>70 PD*	45 PD	<10 °	-----
4	F	Idiopathic	>60 PD*	35 PD	<10 °	-----
12	F	Tumor	50 PD	40 PD	<10 °	10°
15	M	Trauma	60 PD	<10 PD	Full	>75°
18	M	Trauma	35 PD	Ortho	>70°	>75°
20	M	Tumor	40 PD	<10 PD	>70°	>75°
22	F	Trauma	45 PD	Ortho	>70°	>75°
22	M	Trauma	40 PD	25 PD	<20°	20-25°
25	F	Tumor	>60 PD	50 PD	<10°	10°
25	M	Trauma	35 PD	Ortho	Full	>75°
30	M	Trauma	55 PD	Ortho	Full	>75°
30	F	Tumor	40 PD	<10 PD	>70°	>75°
33	M	Trauma	55 PD	40 PD	<10°	10°
38	F	Hypertension	35 PD	<10 PD	>70°	>75°
40	M	Diabetes	40 PD	<10 PD	>70°	>75°
42	M	Hypertension	40 PD	<10 PD	>70°	>75°
45	M	Hypertension	45 PD	<10 PD	>70°	>75°
45	F	Diabetes	30 PD	<10 PD	>70°	>75°
47	M	Diabetes	35 PD	<10 PD	>70°	>75°
48	F	Tumor	35 PD	Ortho	Full	>75°
50	M	Hypertension	40 PD	15 PD	>70°	>60°
51	M	Diabetes	35 PD	15 PD	>50°	50°
55	M	Diabetes	40 PD	Ortho	Full	>75°
60	F	Hypertension	35 PD	Ortho	Full	>75°
61	M	Hypertension	40 PD	<10 PD	>70°	>75°
64	F	Hypertension	40 PD	<10 PD	>70°	>75°
65	M	Hypertension	45 PD	Ortho	Full	>75°
67	F	Giant cell arteritis	30 PD	<10 PD	>70°	>75°
70	M	Diabetes	35 PD	Ortho	Full	>75°

* Bilateral

Twenty four patients (80%) had significant improvement or full abduction after 2-3 months ($T = 32.33$, 95% CI: 28.35-36.30; P value < 0.0005). The remainder six (20%) had under 10 degrees abduction after six months and considered as treatment failures. Among treatment failures two were traumatic and two had brain tumor.

After 3 months twenty two patients had no deviation or were under 10 PD esotropic, while 8 patients had 10-50 prism diopters esotropia (Table 2).

The most frequent complications were minimal vertical deviation (7 cases), ptosis (2 cases) and diplopia (4 cases). All of these were transient and resolved within 2-3 months after injection. No cases of globe perforation, or retrobulbar hemorrhage were encountered.

Table 2. Residual esotropia in the study group

Number of Patients	Percentage	Residual Esotropia
22	73%	No or <10 PD
8	27%	10-50 PD

Discussion

There are contradictory reports about the effect of injecting botulinum in acute sixth nerve palsy.² Botulinum toxin blocks release of acetylcholine, resulting in paralysis of injected muscle about 48-72 hours post injection.¹²

Due to high rates of spontaneous recovery in acute sixth nerve palsy (73%), it may be difficult to interpret the efficacy of any type of treatment.¹³ Botulinum injection was tried as complementary treatment to the surgery¹⁴ or alone (with the use of EMG guide^{15,16}). Also,

sub-Tenon injection of toxin showed comparable results to EMG guided injection.¹⁷ It is less invasive than surgery and more repetitive, does not produce scar and demands local or only brief superficial anesthesia.¹⁸

In this study we performed injection into medial rectus muscle directly like previous report by our colleagues in *Tehran*¹⁵ in which no significant improvement during 1st 2-4 weeks was shown. We observed 80% success rate in our patients similar to what was observed by *Lee et al.*¹⁹ In addition, 73% of our patients had more than 75 degrees of binocular visual field, very similar to the results of a study in *Thailand*.²⁰ This approach is noninvasive and performed under local anesthesia in cooperative patients.

In addition none of patients developed any serious complication and all of observed complications like ptosis and vertical deviation were transient.

Conclusion

We conclude that botulinum toxin injection into medial rectus in acute sixth nerve palsy (of any cause) is a simple, safe, and cheap way to treat diplopia, esotropia, and face turn. Although spontaneous recovery rate is high, it can shorten the recovery time and eliminate diplopia during this phase.

It may eliminate the need for transposition surgery which has the risk of anterior segment ischemia especially in the elderly. In bilateral sixth nerve palsy it seems that surgery is necessary but botulinum toxin injection during the acute phase may be useful to control diplopia.

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