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Araştırma

Efficacy of Botulinum Toxin A Injection in Horizontal Strabismus

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ABSTRACT

Objective: *To evaulate the efficacy of botulinum toxin A injection and factors affecting the treatment in strabismus.*

Material and Methods: *Botulinum toxin A administered 43 patients with the diagnosis of horizontal deviation in Strabismus Department of Okmeydanı Training and Research Hospital Ophthalmology Clinic were analyzed retrospectively. A total of 55 injections were applied to the medial rectus with comitant and noncomitant esotropia or lateral rectus with comitant exotropia and were followed up for 3 months. A deviation of less than 5 prism diopters was considered successful, between 5-10 prism diopters as cosmetically successful and more than 10 prism diopters as unsuccessful.*

Results: *A total of 43 patients (17 female, 26 male) with a mean age of 25.1 (8.54SD) years were included in this study. Of the 43 patients, 26 (60.5%) with esotropia and 17 (39.5%) with exotropia were presented. There were residual strabismus in 16 (37.2%) patients, paralytic strabismus in 19 (44.2%) patients and consecutive strabismus in 8 (18.6%) patients. The angle of deviation was 10-20 prism diopters in 30 (69.8%) patients and up to 20 prism diopters in 13 (30.2%) patients before botulinum toxin A administration. Success rate of patients who had deviation between 10-20 prism diopters was 83.3% and patients who had deviation up to 20 prism diopters was 46.2%. There was a statistically significant difference between angle of deviation ($p<0.05$). There was no statistical difference in the success rates between esotropia, exotropia and between paralytic strabismus, residual strabismus, consecutive strabismus ($p>0.05$).*

Conclusion: *Botulinum toxin A injection, which is effective in the treatment of strabismus, may be an alternative to surgery with minimal side effects especially in mild deviations of less than 20 prism diopters.*

Keywords: *botulinum toxin, esotropia, exotropia, strabismus*

ÖZ

Horizontal Şaşılıkta Botulinum Toksin A Enjeksiyonunun Etkinliği

Amaç: *Şaşılık nedeniyle uygulanan botulinum toksin A enjeksiyonunun etkinliğini ve tedavi etkinliği üzerine etkili olan faktörleri değerlendirmek.*

Gereç ve Yöntem: *Okmeydanı Eğitim ve Araştırma Hastanesi Şaşılık Biriminde horizontal şaşılık nedeniyle botulinum toksin A enjeksiyonu yapılan 43 hastanın kayıtları retrospektif olarak incelendi. Komitan ve nonkomitan ezotropya nedeniyle medial rektusa, komitan ekzotropya nedeniyle lateral rektusa uygulanmak suretiyle toplan 55 ekjeksiyon yapıldı. Hastalar 3 ay takip edildi. 5 prizm diyoptri ve daha az olan kaymalar başarılı kabul edilirken, 5-10 prizm diyoptri arası kozmetik olarak başarılı, 10 prizm diyoptri üzerindeki kaymalar ise başarısız olarak kabul edildi.*

Bulgular: *Ortalama yaşı 25.1 (8.54SD) olan 43 hasta (17 kadın, 26 erkek) çalışmaya alındı. Kırk üç hastanın 26'sında (%60,5) ezotropya mevcutken, 17'sinde (%39,5) ekzotropta vardı. Hastaların 16'sı (%37,2) rezidüel şaşılık, 19'u (%44,2) paralitik şaşılık, 8'i (%18,6) ise konsekütiv şaşılık idi. Otuz (%69,8) hastada kayma açısı 10-20 prizm diyoptri arasında, 13 (%30,2) hastada 20 prizm diyoptrinin üzerindeydi. Kayma açısı 10-20 prizm diyoptri arasında olan hastalarda başarını oranı %83,3 iken, 20 prizm diyoptrinin üzerinde kayması olan grupta %46,2 idi ve kayma açıları arasında istatistiksel olarak anlamlı fark mevcuttu ($p<0,05$). Ezotropya, ekzotropta arasında ve paralitik, rezidüel, konsekütiv şaşılık arasında başarı oranları açısından istatistiksel olarak anlamlı bir fark yoktu ($p>0,05$).*

Sonuç: *Şaşılıkta botulinum toksin A enjeksiyonu özellikle 20 prizm diyoptriden daha az kayması olan olgularda minimal yan etkisi ile birlikte cerrahiye alternatif olabilecek etkili bir yöntemdir.*

Anahtar kelimeler: *botulinum toksin, ekzotropya, ezotropya, şaşılık*

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INTRODUCTION

Botulinum toxin (BTX) is an exotoxin produced by the anaerobic gram-positive bacterium called Clostridium botulinum. It is considered to be the most potent biological toxin found in nature [1,2]. BTX exists as seven serotypes; named A to G, distinctly defined by their individual terminal binding configurations. Of the seven serotypes, only the BTX serotype A (BTX A) can be used in clinical practice [1,3]. BTX A neurotoxin has a molecular weight of 150 kDa and prevents the acetylcholine release from peripheral cholinergic nerve terminals causing reversible muscle paralysis [4].

In ophthalmology, BTX was initially used by Alan Scott at the Smith Kettlewell Institute in San Francisco to treat strabismus in primates in 1973. Since then, BTX has become widely used in blepharospasm, pain syndromes, and facial aesthetics. Presently BTX A is preferred due to its easy administration and transient side effects [1,4].

Nowadays, the use of BTX A has expanded to treat diseases, such as infantile esotropia, sixth cranial nerve palsy, vertical deviations, motor fusion defects, ophthalmoplegia, congenital or acquired nystagmus, eyelid retractions, spastic entropion, blepharospasm, compressive optic neuropathy and acute thyroid orbitopathy with extraocular muscle involvement [5-8].

The aim of this study is to assess the effectiveness of BTX A on the type and angle of deviation, previous surgical interventions such as recession and resection in strabismus.

MATERIALS and METHODS

Patients administered BTX A were followed up at regular intervals in Strabismus Department of Okmeydanı Training and Research Hospital Ophthalmology Clinic and evaluated retrospectively. A total of 43 patients with horizontal deviation were included in this study. A total of 55 injections were applied to the medial rectus with comitant and noncomitant esotropia or lateral rectus with comitant exotropia and were followed up for 3 months.

All injections were performed with transconjunctival approach under topical anesthetic drops. After following eyelid speculum insertion, the patient was instructed to look in the reverse direction of the targeted muscle. Then, the muscle was grasped with forceps and moved vertically to make sure that the targeted muscle was grabbed properly. With the bevel of a 26-gauge needle towards the sclera, a 1 mL/1 inch syringe, was introduced into the conjunctiva 6mm posterior from the limbus into rectus muscle, advanced 4-5 mm before the injection and 2.5-5 IU BTX A was injected into each rectus muscle.

After the correction of refractive errors, the angle of deviation was measured by performing prism cover test before the injection. Patients having vertical deviations were excluded. Krimsky tests were carried out in patients with a weak fixation. Subsequently, the values were recorded in prism diopters.

A deviation of less than 5-prism diopters (PD) was considered successful, between 5-10 PD as cosmetically successful and more than 10 PD as unsuccessful. Chi-square test was performed for statistical analysis.

RESULTS

A total of 43 patients (17 female, 26 male) with a mean age of 25.1 (8.54SD) years were included in this study. Fifty-five injections were performed in 43 patients.

Of the 43 patients, 26 (60.5%) with esotropia and 17 (39.5%) with exotropia were presented. There were residual strabismus in 16 (37.2%) patients, paralytic strabismus in 19 (44.2%) patients and consecutive strabismus in 8 (18.6%) patients.

BTX A was administered into healthy muscle in 25 patients, recessed muscle in 13 patients, and resected muscle in 5 patients. All injections were performed on horizontal rectus muscles.

The angle of deviation was 10-20 PD in 30 (69.8%) patients and more than 20 PD in 13 (30.2%) patients before BTX A administration. Success rate of patients who had deviation between 10-20 PD was 83.3% and patients who had deviation more than 20 PD had 46.2%. There was a statistically significant difference between angle of deviation ($p=0.013$).

BTX A administration was found to be successful in 73.1% of 26 esotropic cases and 70.6% of 17 exotropic cases with the first administration. There was no statistical difference in the success rates between esotropia, exotropia (p=0.859).

Success rates of 73.7% in 19 cases of paralytic strabismus, 75% in 16 cases of residual strabismus, 62.5% in 8 cases of consecutive strabismus were achieved. There was no statistical difference in success rates between paralytic strabismus, residual strabismus and consecutive strabismus (p=0.796). Success rate of BTX A injection is shown in Table 1.

Table 1. Success rate of botulinum toxin A injection.

	Successful		Cosmetically successful and unsuccessfu		
	N	%	N	%	p
Esotropia	19	73.1	7	26.9	
Exotropia	12	70.6	5	29.4	0.859
Surgical Attributes					
Residual	12	75	4	25	
Consecutive	5	62.5	3	37.5	
Paralytic	14	73.7	5	26.3	0.796
Deviation prior to BTX inj.					
10-20 PD	25	83.3	5	16.7	
>20 PD	6	46.2	7	53.8	0.013

Chi-square test

Ptosis was seen in 7 injections (12.7%). Subconjunctival hemorrhage was found in 22 cases (40%). Only one case with vertical deviaton was observed as a side effect of BTX injection (2.3%). None of the patients showed serious side effects or had complications such as scleral perforation or allergic reactions.

DISCUSSION

BTX, which is a competitor of acetylcholinesterase enzyme at the neuromuscular junction, binds to peripheral presynaptic cholinergic nerve endings and causes a flaccid paralysis when injected into muscle. This effect is temporary and lasts for 40 to 60 days.

When spectacles, prisms, pharmacological agents, and orthoptic exercises fail in keeping eyes parallel to each other, surgery becomes the next step. Although surgical treatment is often successful, incision and sutures commonly cause discomfort and, in some cases, ocular inflammation. In addition, out-patient care would be much more affordable and efficient than hospitalization. Thus, BTX A treatment is a great alternative to surgery in many indications. In studies with infantile or acquired esotropic patients, no difference has been reported between the outcomes of BTX A and surgery. However, BTX A has appeared to be less effective than surgery for patients with horizontal deviation and poor binocular vision [9,10].

It has been reported that among horizontal deviations, response of esotropic patients to treatment is better than those of exotropic patients. Exotropic patients usually need more injections for recovery [11]. According to Scott et al. [7] the angle of deviation of less than 10 PD had been managed only in 53% of 239 exotropic patients. In our study, the success rate of BTX A treatment was found to be 73.1% in esotropic patients, while it was 70.6% in exotropic patients. We found no difference between esotropic and exotropic strabismus.

Many studies have shown that the pretreatment angle of deviation is the main parameter which affects the outcome of BTX A treatment [12,13]. Paul [14] reported that BTX A injection is as effective as surgery in mild and moderate cases (<30 PD), while surgery should be the choice in severe cases (>30 PD). In our study, the success rate of BTX A injection was 83.3% in patients with less than or equal to 20 PD, whereas 46.2% of patients with 20 PD and above were similar to published reports.

It is already known that the majority of abducens nerve palsies recover spontaneously. However, antagonist muscle contracture after rectus muscle palsies may cause permanent esotropia and diplopia. BTX A injection prevents the contracture and reduces the complaints of the patient until functional recovery of the abducens nerve. In 70% of our patients, improvement in diplopia was initialized in the first week and resolved in one month after injection.

In conclusion, BTX A injection, which is effective in the treatment of strabismus, may be an alternative to surgery especially in mild deviations of less than 20 PD. It is a viable method with minimal side effects and, most importantly, reduces patients' diplopia and other complaints that arise from acute onset deviations.

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