Botulinum Toxin Treatment for Esotropia

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ABSTRACT

Botulinum toxin (BOTOX®) has been reported to have success as an alternative to traditional surgery for patients with infantile and early onset acquired strabismus. Selected cases with smaller angles may do well with botulinum toxin as a primary treatment; however, the large angle associated with most cases of infantile esotropia in my experience prevents its use. We report the use of botulinum toxin injection into the medial rectus of patients who have already undergone standard incisional medial rectus recessions for esotropia but still have a residual deviation.

INTRODUCTION

Botulinum toxin (BOTOX®) is a naturally occurring toxin. It acts by blocking release of acetylcholine into the synaptic cleft of neuromuscular junctions, which creates a chemical denervation of the muscle and results in decreased skeletal muscle force generation. The effect of botulinum toxin is temporary, lasting approximately three months.

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Botulinum toxin is utilized in many different specialties of medicine for the treatment of disorders that affect the neuromuscular junction. The classic example is benign essential blepharospasm, where injection of botulinum toxin into the obicularis oculi and other facial muscles is an effective, safe, and well-accepted treatment. Botulinum toxin is also used in neurology for the treatment of spastic cerebral palsy and various dystonias, and also in orthopedics for the treatment of idiopathic spastic torticollis.

In theory, the use of botulinum toxin for the treatment of strabismus is extremely attractive. Extraocular muscles are easily accessible for direct injection, and the temporary denervation produced by botulinum toxin can be helpful in preventing the secondary contractures associated with acute extraocular muscle palsies, al-

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lowing for limited single binocular vision while the natural spontaneous resolution occurs without any additional surgical intervention.

Despite the theoretical advantages of botulinum toxin in the treatment of strabismus, the widespread acceptance of botulinum toxin for the treatment of comitant horizontal strabismus of childhood has been much slower to occur for many reasons.

The following is my rationale for not using botulinum toxin as a primary treatment in my academic practice:

BOTULINUM TOXIN FOR INFANTILE ESOTROPIA

Several outcome studies have been reported for the treatment of infantile esotropia using botulinum toxin, many of which were by McNeer.[1] While classic infantile esotropia has a deviation of magnitude typically larger than 40$^{\Delta}$, the mean angle of patients reported by McNeer was only 33$^{\Delta}$ for children over age 12 months at injection, and 43$^{\Delta}$ for children age less than 12 months. Despite this relatively small angle, only 41% of those treated before age 12 months were successfully aligned with one injection, and only 63% of the older children. Thus, at least half of the patients treated with botulinum toxin, even for these small angles, will require a second surgical procedure within a relatively short period of time. This is substantially greater than that published for most patients having incisional surgery. Since anesthetic risks occur primarily during induction and emergence, and are not particularly dependent on procedure length, I believe botulinum toxin imparts too much anesthesia risk in the management of children with infantile esotropia.

PARTIALLY ACCOMMODATIVE ESOTROPIA

Botulinum toxin has also been reported to be successful in the management of partially accommodative esotropia. Its use here is theoretically more attractive because the angle of deviation is smaller. The prospective study by Tejedor and Rodriguez showed long-term (mean 4.8 years) successful follow-up in only 53% of children.[2] For comparison, the prospective prism adaption trial (PAT Study) found that patients who responded to their prisms and were operated on for their prism adapted angle had over a 90% success rate at one year postoperatively. This is too large a disparity in outcome rates for me to consider botulinum toxin a primary treatment for partially accommodative esotropia.

BOTULINUM TOXIN IN THE MANAGEMENT OF ESOTROPIA IN OLDER CHILDREN

One of the side effects of botulinum toxin is that it can diffuse throughout the orbit, producing vertical deviations and ptosis. Unfortunately, the frequency of this side effect does not appear to be dose dependent, and can occur for any volume of injection. Suggested methods of preventing extravasation of botulinum toxin into the orbit have not been successful. Although these side effects are of course temporary, they can be disconcerting to parents. For young children, these effects are of minimal concern, but for the child who is in pre-kindergarten or elementary school, the psychological effect of a large-angle exotropia or large bilateral or unilateral ptosis cannot be overestimated, even if temporary. In addition, many older children will experience diplopia upon such a large change in their alignment. For these reasons, I do not use botulinum toxin for children aged 5 years or older.

BOTULINUM TOXIN USE IN RESIDUAL ESOTROPIA

One of the rare indications for botulinum toxin treatment in the management of childhood strabismus may be in the treatment of children with residual esotropia following maximal bilateral medial rectus recession. The dose-response cure for bilateral lateral rectus muscle resection in this situation exhibits extreme variability,[3] and many children who have bilateral lateral rectus muscle resections are initially well aligned but develop a secondary exotropia during late childhood. This requires a third surgical procedure. Injection of botulinum toxin into both medial rectus muscles in this setting is a potentially very attractive option. In this situation, the magnitude of the residual deviation is substantially less than with infantile esotropia and partially accommodative esotropia and the dose-response curve between deviation magnitude and amount of surgery needed has much less variability. The theoretical advantage of botulinum toxin in this setting is that the temporary exotropia can produce a physiologic shortening of the lateral rectus and thus act as a chemical resection. As the exotropia resolves with time, a child who has the ability to fuse will experience various degrees of small-angle tropia within the monofixation range and this may in some way allow the redevelopment of fusion without another surgical procedure.

Tejedor and Rodriguez reported results from a series of children treated with botulinum toxin for early reoccurrence of esotropia. Over 60% of treated patients were successfully aligned with a single injection of botulinum toxin into both medial rectus muscles.[4]

In my practice, we have recently adapted a similar approach for the treatment of recurrent of residual esotropia in children under age four who have previously had medial rectus muscle recessions to at least 10.5 mm from the surgical limbus for the initial treatment of their infantile esotropia, and whose residual angle of esodeviation is now 25^{Δ} or less. We have thus far treated seven children in what currently is a prospective evaluation. Excluded are patients who have inferior oblique overaction that requires inferior oblique surgery or a vertical deviation that would require traditional incisional surgery. The advantages of such an approach include decreased surgical time, smaller incisions over the medial rectus muscles, and that the lateral rectus and inferior oblique are kept free of scar tissue for future surgeries. Our initial results appear promising, yet recurrence of esotropia still appears to be a problem. However, if these results can be confirmed, they form an excellent basis for preliminary data supporting a randomized controlled trial of botulinum toxin versus traditional surgery for the patients with residual esotropia.

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