RECENT USES OF BOTULNUM TOXIN IN OPHTHALMOLOGY

Essay

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By

George Halime Shinuda

(M.B., B.Ch)

Supervised by

Prof. Dr. Sherif Zaky Mansour

Professor of Ophthalmology

Faculty of medicine, Ain shams university

Dr. Thanaa Helmy Mohamed

Assistant Professor of Ophthalmology

Faculty of medicine, Ain shams university

Dr. Rania Gamal-El Din Zaky

Lecturer of Ophthalmology

Faculty of medicine, Ain shams university

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Abstract

Backgound: Botulinum toxin, also called “miracle poison,” is one of the most poisonous biological substances known.

Scott first demonstrated the effectiveness of botulinum toxin type A for the management of strabismus in humans

Aims: The aim of this study is to review recent updates in uses of botulinum toxin in management of different ophthalmological disorders.

Conclusion: Botulinum toxin is one of the most poisonous biological substances known. ***Scott*** first demonstrated the effectiveness of botulinum toxin type A for the management of strabismus in humans

The structure of Botulinum toxin differs from serotype to another as it exists as seven distinct serotypes, designated A--G, each with differing terminal binding configurations.

Keywords: Botulinum toxin, ophthalmology

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Contents

List of Abbreviations

Ach	: Acetylcholine
ALO	: A praxia of lid opening
BONT	: Botulinum Toxin
BONTA	: BONT type A
BONTA-abo	: Abobotulinumtoxin A
BONTA-inco	: Incobotulinumtoxin A
BONTB-rima	: Rimabotulinumtoxin B
BT	: Botulinum toxin
cGRP	: Calcitonin gene-related peptide
EMG	: Electromyographic
FDA	: Food and drug administration
IOP	: Intraocular pressure
Ketalar	: Ketamine hydrochloride
KDa	: Kilodaltons
NAPs	: Neurotoxin associated peptides
PFP	: Peripheral facial paralysis
PSP	: Progressive supranuclear palsy
SMAS	: Superficial muscular and aponeurotic system

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Introduction

Botulinum toxin, also called "miracle poison," is one of the most poisonous biological substances known ***(Münchau and Bhatia, 2000).***

Scott first demonstrated the effectiveness of botulinum toxin type A for the management of strabismus in humans ***(Scott, 1981).***

Subsequently, botulinum toxin was approved for the treatment of numerous disorders of spasticity ***(Münchau and Bhatia, 2000).***

The structure of Botulinum toxin differs from serotype to another as it exists as seven distinct serotypes, designated A--G, each with differing terminal binding configurations ***(Comella and Pullman, 2004).***

The mechanism of action of botulinum toxin acts on cholinergic nerve terminals blocking the release of the neurotransmitter acetylcholine ***(Turton et al., 2002).***

The clinical uses of Botulinum Toxin in Ophthalmology is variable as it is used in

- ***Movement Disorders and Focal Dystonia***

    - *Benign Essential Blepharospasm:* Benign essential blepharospasm is a focal cranial dystonia involving the eyelid and forehead muscles ***(Dutton and Fowler, 2007).***

    - *Oromandibular Dystonia:* Oromandibular dystonia is a focal movement disorder affecting the lower face. It is characterized by spasms along the sides of the nose, the mouth, and chin ***(Fahn, 1984).***

- ***Chronic Dry Eyes:*** Usually due to inadequate tear production from lacrimal hyposecretion or to excessive tear evaporation ***(Gore et al., 2013). Sahlin et al. (2000)*** injected 2.5--3.75 U botulinum toxin into the medial portion of the orbicularis muscle of the lower lid or to both the upper and lower lids to reduce the effectiveness of the orbicularis muscle pump mechanism around the canaliculi.

- ***Elevated Intraocular Pressure From Restrictive Myopathy:*** Kikkawa et al have reported a reduction in IOP in eight patients following injection of 10--15 U

botulinum toxin into the inferior rectus muscle ***(Kikkawa et al., 2003).***

- ***Congenital and Acquired Nystagmus and Oscillopsia:*** Studies have advocated injecting botulinum toxin directly into multiple rectus muscles reported a diminished amplitude of nystagmus and improved visual acuity in 43% and 50% of patients with congenital nystagmus ***(Oleszczyn, 2004).***

- ***Headache Syndromes:*** Because migraine and other headaches often are associated with visual disturbances, management can be of ophthalmic significance. Smuts et al showed that botulinum toxin could reduce the frequency of migraines by 50% ***(Smuts et al., 2004).***

- ***Hyperhidrosis and Lacrimal Hypersecretion Syndromes:*** In cases of lacrimal hypersecretion from any cause, injection of 2.5--5 U botulinum toxin into the palpebral lobe of the lacrimal gland results in a clinically significant reduction in tear production and improvement in symptoms of epiphora in the up to 75% of patients ***(Keegan et al., 2002).***

- ***Aesthetic Uses:*** Offlabel applications have now expanded to the treatment of many other areas of the face and include ‘‘crows feet’’, transverse brow and forehead furrows, ‘‘smokers lines’’ (perioral rhytids), ‘‘marionette lines’’ (mesolabial folds), and platysmal bands ***(Lowe et al., 2002).***

- ***Corneal Protective Ptosis:*** This procedure offers a valuable adjunct to the management of corneal diseases that would otherwise requiring long-term patching or tarsorrhaphy ***(Mackie, 2004).***

- ***Entropion:*** Temporary relief can be achieved by weakening lower eyelid muscle tone with 5--10 U botulinum toxin injected into the pretarsal or pre-septal orbicularis muscle. This can completely eliminate the entropion for up to 3--4 months ***(Steel et al., 1997).***

- ***Eyelid Retraction:*** Studies have shown an average drop in lid position of 2--3 mm, for a duration of 8--14 week ***(Shih et al., 2004).***

- ***Apraxia of Eyelid Opening:*** The inability to initiate levator muscle contraction and failure to sustain lid elevation suggests an abnormality of central motor control ***(Defazio et al., 1998).***

- ***Strabismus:*** For infantile esotropia, McNeer and others have shown that early intervention using simultaneous bimedial rectus muscle injection with botulinum toxin can reestablish motor and sensory fusion with good long term results comparable with that reported for surgical correction ***(McNeer et al., 2003).***

Aim of the work

The aim of this study is to review recent updates in uses of botulinum toxin in management of different ophthalmological disorders.

Anatomy of Facial Muscles

Muscles of scalp face and neck:

The facial muscles are a group of striated muscles innervated by the facial nerve that, among other things, control facial expression. These muscles also called mimetic muscles ***(Fridlund, 2014).***

The facial muscles are just under the skin in that's why they control facial expression. Generally they originate from the skull bones to be inserted in the facial skin .Most of facial muscles innervated by the facial nerve except masticatory muscles by mandibular nerve, a branch of trigeminal nerve. The face is made up of 10 groups of muscles .The group in scalp area consists of long, flat, smooth muscles that has the ability to move forward and backward. Other fibers and tissues allow the movement to take place easily. Keeping the scalp pliable is very important to the nourishment of skin and hair as it helps keeping the glands and blood vessels healthy ***(Faigin, Gary, 2012).***

The second group is made of three small muscles that are located in the above and behind external portion of the ear. They have very little movement but provide protection for veins and nerves and integrate with other muscles and tissues ***(Tolhurst, David, 1991).***

The next two groups cover the eye lid the surrounding orbital area and the inside of the eye socket. They provide voluntary and involuntary blinking tear duct control as well as movement of the eye ball. The nasal region has several small muscles that actually do big jobs. They extend and interconnect other muscles all the way from the skull to the upper lid. They operate the nostrils so that we can flair or compress them, lift the upper lid and draw the brows down. They also control some facial features ***(Tolhurst, David, 1991).***

The mouth is surrounded by 3 muscle groups that have multiple functions. They can pull the comers of the mouth up or down, make as packer or grin and help other muscles with obeying and numerous other necessary duties in the course of life. One of these duties is to give facial expression ***(Benninger and Daniel, 2012).***