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MIOR 2019

Extra-Ocular Muscles injections
for Comitant Strabismus

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No financial interest

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Botulinum toxin in strabismus

History..

- In 1822, Justinus Kerner, 230 cases of botulism,
- In 1928- neurotoxin was first purified
- 1989- FDA approved Oculinum (type A) to treat strabismus, blepharospasm, and hemifacial spasm

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Pharmacology

- • Botulinum toxin exists as 7 distinct serotypes,
 - A—G

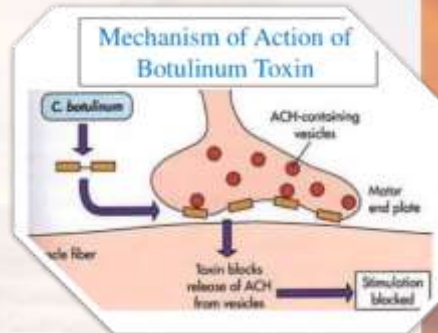
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MECHANISM OF ACTION

- Acts on cholinergic nerve terminals.
 - inhibits neuromuscular transmission
 - by blocking the extracellular release of acetylcholine
- After injection of botulinum toxin in the region of the target muscle:
 - binds to receptors on the bouton of the terminal nerve cell surface
 - Results in local chemodenervation of the muscle causes a muscle paralysis



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ACTION lasts for how long?

- Botulinum toxin starts to have an effect on muscles after **24-48 hours**
- maximum muscle weakening effect after **two weeks**
- The muscle will normally regain its normal function after **3-4 months**.
(muscle cells develop new receptors)
- However, after repeat treatments the effect can be longer **lasting**.

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ACTION lasts for how long?

- ocular realignment may persist even after the effect of chemodernervation has worn off.
- Temporary paralysis induced by Botox favors activation of its antagonist.
 - In patients good potential for stereopsis:
 - restoration of fusion
 - changes that occur in vergence fusional amplitudes and muscle dynamics during the temporarily induced paralysis
 - can impact a permanent cure.

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ACTION lasts for how long?

- Esotropia As an example, injecting MR:
 - unopposed LR which becomes tighter & stronger.
- After the effect of Botox has worn off:
 - a balance would be reached between medial rectus and the tightened lateral rectus
 - effect of the injection may become permanent.

MR ↓ ↑ LR



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Indications of Botox in Strabismus

- Paralytic
- Restrictive
- Concomitant
- Nystagmus

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Commitant

- Partially Accommodative ET
- Infantile ET
- Intermittent exotropia
- Sensory ET/XT
- *late-onset esotropia.*
- Preoperative diagnostic tool in adult patients by simulating a surgical result and predicting the postoperative diplopia.

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Incomitant

- In sixth CN palsy: Weakening the Ipsilateral MR
 - temporary paralysis of the overacting antagonist muscle.
 - avoids contracture of the chemodenedervated muscle
 - until paralyzed muscle returns to its function.
 - useful zone of single binocular vision
 - avoid uncomfortable head posture.
- Before *transposition procedure*: e.g to MR for a complete sixth n palsy
 - 2-3 weeks before transposition surgery
 - Avoid operating on 3 recti, avoid anterior segment ischemia

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Incomitant

- SOP: ipsilateral inferior oblique
- Tight muscles in *TED myopathy* in the florid stage (not fibrosis stage)
- acquired nystagmus with *oscillopsia*.
 - Retrobulbar injections or injections in the horizontal rectus muscles

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Complications

- Ptosis (15-20%)
- Induced deviations
- Diplopia

Transient

- Dilated pupil
- Reduced accommodation
- Scleral perforation
 - Rare



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Commercially available

- Botulinum toxin type A is commercially available as two preparations:
 - Botox (Allergan Inc, Irvine, CA) (Worldwide)
 - Dysport (Ipsen Pharmaceuticals, France). (European Union)
- Botulinum toxin type B
 - Myobloc (Élan Pharmaceuticals, South San Francisco, CA). (United States)



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Procedure

- The original approach (Scott):
 - injecting EOM under electromyographic (EMG) control.
- Tolerated in adults,
- Requires sedation with ketamine hydrochloride (Ketalar) in children (preserve muscle activity on EMG).

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EMG Guided

- Electrode is placed on the forehead of the patient
- Topical anesthesia.
- The conjunctival at site of injection is anesthetized
 - by application of a cotton swab soaked with Xylocaine.



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EMG Guided

- Needle electrode (27 Gauge) connecte
 - EMG apparatus
 - Regular insulin syringe containing Botox
 Only the tip of the needle is not insulated.



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Dose
5 units

100 unit
/ 5 ml
each ml = 20 Unit

/ 2.5 ml
each ml = 40 Unit



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Aug. 24th 2016 at MIOR



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- The needle is inserted transconjunctivally into the muscle close to its insertion.
- moved forward tangentially.
- The patient is then asked to move the eye in the *direction of action* of the muscle to be injected
- If the needle has been placed correctly an EMG signal appears on the monitor or an auditory response is obtained as well.
- At this point Botox is injected into the muscle.
- Expect the sound to FADE down during injection!
- WAIT for 35 sec. before removing the needle (eliminate the spill)



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Botox to Rt MR

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PRE- INJECTION



After Rt MR Botox



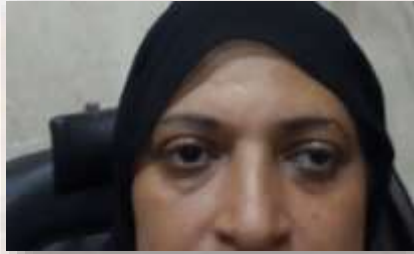
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Comitant XT.

Post Bil. LR botox



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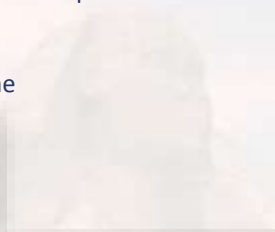
- Recently: Trial of adding *Bupivacaine* injection in the ipsilateral antagonist as Strengthening
- Concentration 3% - 0.75%
- Effect can be augmented by adding epinephrine

Pharmacologic injection treatment of comitant strabismus

Iraa Debert, MD, PhD,^{1,2,3,4} Joel M. Miller, PhD,^{5,6} Kenneth K. Dash, BS,^{3,6} and Alan B. Scott, MD

PURPOSE To report the magnitude and stability of corrections in constant horizontal strabismus achieved by injecting bupivacaine (BPV, optionally with epinephrine) and botulinum A toxin (BTXA) into extraocular muscles of adult strabismic subjects with electromyographic (EMG) guidance.

METHODS A total of 15 adults with constant horizontal strabismus participated in a prospective observational clinical series. Of these, 79 previously had undergone 1 or more unsuccessful strabismic surgeries; 4 had undergone other orbital surgeries. Thirty-one patients with exotropias received BPV injections in a lateral rectus muscle, none with BTXA in the medial rectus; 24 patients with esotropias received BPV in a medial rectus muscle, none with BTXA in the lateral rectus muscle. A second treatment (BPV, BTXA, or both) was administered to 17 patients who had residual strabismus after the first treatment. Five patients required additional injections. Clinical alignment was measured at 6 months and yearly thereafter through 1 year's follow-up, with mean follow-up of 20 months. An-



Current Treatment Doses (Averages)

Initial Deviation (Δ)	Bupivacaine (μg/mL)		Toxin (U)	Epi
8 - 15	1.5	1.5	0	0
16 - 30	2.5	2.0	2.5	-
> 30	3.0	3.0	5.0	++

Bupivacaine 0.5%
(Latter's R, Compounding, San Jose, CA)

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ANESTHETIC MYOTOXICITY AS A CAUSE OF RESTRICTIVE STRABISMUS AFTER SCLERAL BUCKLING SURGERY

REYDAN SALAMA, MD, FRCS, ARASH K. FARR, MD, DAVID S. GUTMAN, MD

maintaining two cases the globe was well positioned in movement by presumed scarring, which seemed to be located posteriorly in the orbit.

Anesthesia records could be obtained for 28 of the 36 cases (78%). Local anesthesia was documented as the method of anesthesia for all but one of these retinal reattachment procedures. In most of these, a combination of xylocaine 2 or 4% bupivacaine 0.75% and hyaluronidase was administered as retrobulbar injection. In a few cases the same anesthetic mixture was given at the end of surgery for postoperative pain control. During the one case performed under general

restricted by peritubular scarring caused by the scleral buckling procedure. The distribution of the muscles involved is very similar to the distribution of muscles involved after retrobulbar or peritubular anesthesia for cataract surgery, especially when long-acting anesthetic agents are used.

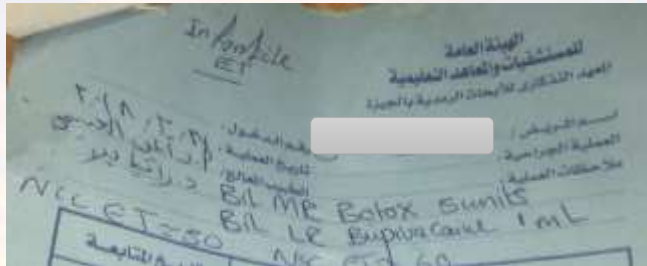
By releasing the tight muscles in postscleral buckling procedures, we have obtained relatively good alignment results, suggesting that it is the tight muscle primarily causing the strabismus rather than peritubular scarring.

strabismus after scleral buckling surgery with increasing frequency. We suspect this is because of the increasing use of long-acting local anesthesia for these cases (over 90% of the current cases performed by our

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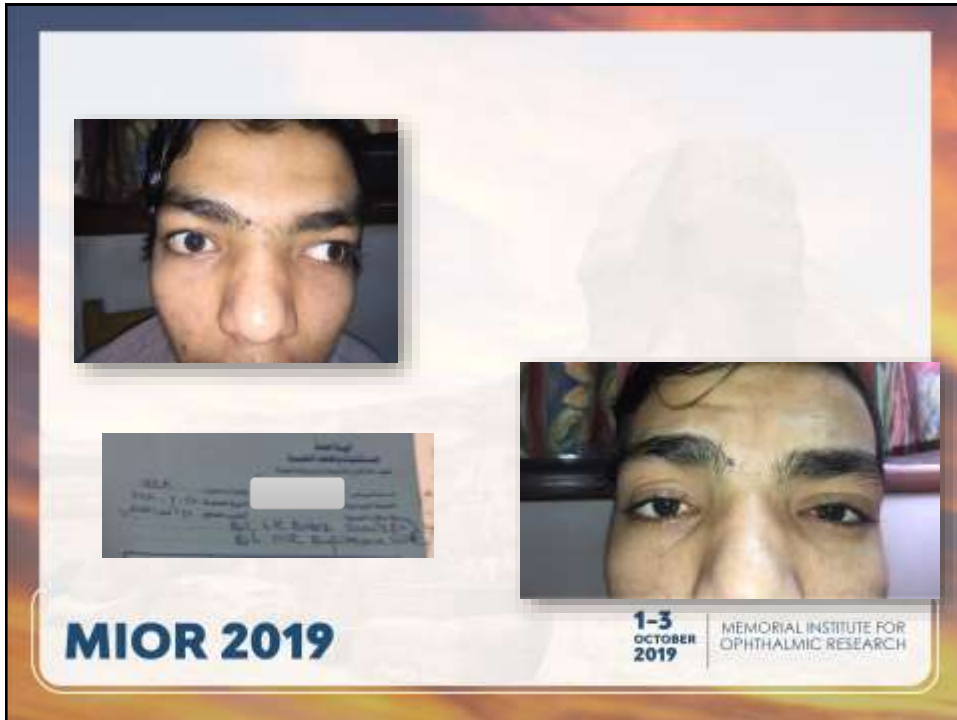
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TAKE HOME MESSAGE

- Botox is a very good alternative to eye muscle weakening Surgery.
- Bupivacaine is a new alternative for strengthening.
- Fast, sutureless, spare the blood circulation
- Easily repeatable, yet one injection can last...
- In adults: Use EMG guidance

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THANK YOU

