

Botulinum Toxin in Plastic Surgery: Experience and Indications in 1200 Treated Areas

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ABSTRACT

The author reports his experience with the use of botulinum toxin for the treatment of facial wrinkles, facial asymmetry and other pathologies in 509 patients, with a total of 1200 areas applied for a period of 32 months. Botox[®] was injected into muscles responsible for expression and facial wrinkles. The main zones treated were periorbital, frontal, glabellar and cervical. The toxin was also used aiming at improving facial asymmetry caused by nervous injury, blepharospasm, cervical dystonia, masseteric hypertrophy and axillary hyperhidrosis. Pharmacological aspects are reviewed, as well as the injection technique, dose, complications and results.

INTRODUCTION

Botulism is known since the 18th Century. In 1897, *Clostridium botulinum* bacteria was found to produce eight different types of toxins. Type A, or Botox[®], is a potent neurotoxin. It acts in cholinergic termination zones, blocking acetylcholine at neurimotor plate and leading to muscle paralysis.

As a function of the traction that given muscle groups exert on the skin surface, the formation and stressing of expression wrinkles occur with the course of time. Thus, an important improvement of expression lines is obtained through the muscle paralysis action obtained with the drug application. This blocking action brings

benefits to other conditions where muscle hyperactivity exists.

PHARMACOLOGY

From the eight toxins produced by *Clostridium botulinum* bacteria (A, B, C₁, C₂, D, E, F and G), seven are associated to muscle paralysis. Type A botulinum toxin is a neuromuscular joint blocking agent. It promotes the neurotransmitter - acetylcholine - blockade at the presynaptic neuron, leading to muscle paralysis. Type B and F toxins are indicated to cases of type A immunity after repeated injections.

The drug inhibition mechanism comprises three distinct processes. First, there occurs the binding of toxin to presynaptic neuron specific receptors at the neuromuscular joint plane. Following, there occurs the internalization or penetration of the specific receptor. Finally, there is the inhibition of acetylcholine release. The effects of striated musculature weakening and paralysis appears around the 2nd or 3rd day after injection, remaining for an approximate period of six months, depending on the dose applied and on each case.

In spite of the deinnervation being permanent, muscle function recovery generally occurs. This is due to the neurogenesis phenomena, with the formation of axonal sprouts, new plates and nervous terminations and the absorption of devitalized neurons⁽⁴⁾.

Drug dosage is expressed in international units (IU). Toxicity is expressed in units, 1 toxin unit (0.4 mg) representing the average lethal dose observed in a group of Webster mice (LD50). Toxic amount for an individual weighting approximately 70 kilograms is believed to be from 2,500 to 3,000 units. Botulinum toxin is free from great side effects. It does not surpass the cerebral barrier and symptoms related to central nervous system do not occur.

INDICATIONS

The first clinical use of toxin is dated 1973 through injection into monkey extraocular muscles. In 1980, Scott started its use in patients bearing cross-eye^(7,8). Then, it was used for the treatment of blepharospasm⁽⁹⁾, paralysis of nystagmus eye rectus muscle⁽⁵⁾, hemifacial spasm⁽¹¹⁾ and facial asymmetry⁽³⁾. As from there, a number of clinical indications were encountered, as in cervical dystonia (spasmodic wry-

neck), oromandibular dystonia, spasmodic dystonia, thrills, cerebral paralysis, masseteric hypertrophy⁽¹⁰⁾, anal fissura, achalasia and others. In 1991, Carruthers showed his experience with the use of the drug in patients bearing glabellar wrinkles⁽²⁾. In 1996, Matsudo reported his preliminary evaluation of fronto-glabellar wrinkles⁽⁶⁾. In 1996, Bushara suggested the use of the toxin in axillary hyperhidrosis⁽¹⁾.

CONTRAINDICATIONS

Despite no teratogenicity reports exist, the employment of the toxin in pregnant or lactant women is not indicated. Neuromuscular alterations are relative contraindications. Patients bearing allergy to human albumin, one of the drug components, shall not use it. Care should be taken specially when there is concomitant use of aminoglycosides, once its toxic action is potentialized.

MATERIAL AND METHODS

Type A botulinum toxin - *Botox*[®], stored under refrigeration was reconstituted into 4 ml of 0.9% physiological saline without preservative, in a concentration of 25 U/ml.

During 32 months, 509 patients bearing wrinkles localized at frontal, glabellar, orbital and cervical regions, as well as those bearing facial asymmetry and other pathologies, were selected for treatment, with a total of 1,200 applied areas. The photographic documentation followed a strict distance and luminosity pattern. Photos were taken before and between three and six month after application.

The regions treated were the frontal, glabellar, periorbital, cervical, axillary and masseteric ones, besides

Table I

Region	Main Muscles Treated	Cases	%
Periorbital	Eyelid Orbicular	571	47.6
Glabellar	Procerus, Corrugator and Orbicular	278	23.2
Frontal	Frontal	266	22.2
Axillary	Subcutaneous Injection	59	4.9
Cervical Anterior	Platysma	10	0.8
Nasogenian Furrow	Major and Minor Zygomaticus and Risorius	6	0.5
Cervical Lateral	Sternocleidomastoid	5	0.4
Masseteric	Masseter	5	0.4
Total		1,200	100



Fig. 1a - 43 y. o. patient with wrinkles at frontal region.
Fig. 1a - Paciente de 43 anos com rugas na região frontal.



Fig. 1b - Five months after treatment.
Fig. 1b - Cinco meses após o tratamento.

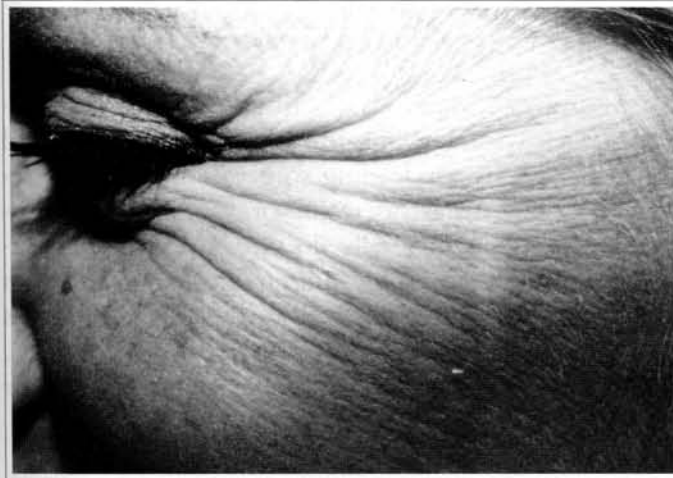


Fig. 2a - 37 year-old patient with wrinkles at periorbital region ("crowfoot").
Fig. 2a - Paciente de 37 anos com rugas na região periorbital ("pés-de-galinha").



Fig. 2b - Five months after treatment.
Fig. 2b - Cinco meses após o tratamento.



Fig. 3a - 36 year-old patient with wrinkles at glabellar region.
Fig. 3a - Paciente de 36 anos com rugas na região glabellar.



Fig. 3b - Four months after treatment.
Fig. 3b - Quatro meses após o tratamento.

nasogenian furrow. The main muscles treated were the frontal, corrugator, procerus, eyelid orbicular, platysma, masseter, sternocleidomastoid ones and, in case of facial asymmetry, the major and minor zygomaticus and the risorius ones (Table I). The injections were applied with the patient seated, without anesthesia, using insulin-type syringe with fine needle (30 grams). After passing through the skin and reaching the muscle, the needle was pulled approximately 1 millimeter and the solution injected. Local manual compression followed. Recommendations post-treatment were reduced to exercising facial mimics within the first hours, remaining in orthostatic or seated position and not handling the region.

RESULTS

During 32 months 509 patients were treated with a total of 1200 applied areas. A high muscle paralysis degree was reached with the consequent improvement of symptoms in practically all cases (Figs. 1 to 4). Only 17 patients needed reapplication before a four month period (3.3%). The effects were noticed within 24-48 hours after injection, being enhanced in up to seven or ten days and remaining stable for approximately four to six months. Patients bearing facial asymmetry had a more transient result (three months), probably due to the fact that the dose used had been lower, as well as in the case of blepharospasm (Figs. 5 and 6). There was, however, an important improvement in the harmony and balance between the two sides of the face. At periorbital region - the most applied area - there was a significant increase of side portion of

eyebrow, providing a more jovial aspect to the patient.

Patient's age ranged from 24 to 81 years old (average of 49.44). From these, 431 were females (84.7%) and 78 males (15.3%). The average amount injected varied according to the applied areas, being approximately 20-25 U at periorbital regions, 15-20 U at glabella and 15 U at frontal region.

Ecchymosis occurred at injection site in four cases (0.8%). Short-term cephalgia was reported by four patients (0.8%). Major complications related to weakening of muscle next to applied areas by migration or accidental injection. Unilateral eyelid ptosis occurred in one patient (0.2%) with a discrete deviation of ocular globe that persisted for approximately ten days, resolving spontaneously.

DISCUSSION

Several are the methods described aiming at attenuating facial wrinkles. Surgical intervention is required for many of them, leading sometimes to delayed recovery, non-satisfactory results or scars. Injectable synthetic products generally do not have a definite result, are expensive, may migrate and some of them require previous testing before use. Fatty graft does not give good results concerning periorbital wrinkles, and its results are transient, besides requiring a donor site.

Botulinum toxin application showed to be a simple, non-surgical, safe and efficient method for the treatment of facial wrinkles, mainly in its lower third. It



Fig. 4a - 52 year-old patient with platysma bands at cervical region.

Fig. 4a - Paciente de 52 anos com bandas de platysma na região cervical.



Fig. 4b - Four months after treatment with Botox.

Fig. 4b - Quatro meses após tratamento com Botox.

presents few complications, is reversible, may be re-applied several times and is easy to be obtained.

Some classical surgeries, such as the corrogator muscle excision, may be satisfactorily substituted by the repeated application of this substance. Selected cases of facial asymmetry caused by iatrogenic lesion or other etiologies also get good results with this drug. Transient paralysis of frontal region post rithidoplasty may be properly controlled with counterlateral small injections of the toxin till recovery of injured side, exceedingly decreasing patient and surgeon's anxiety. This non-surgical option shows important advantages for bearers of masseteric hypertrophy and axillary hyperhidrosis in relation to traditional treatments.

CONCLUSION

The use of botulinum toxin is adjoining traditional methods and represents a safe and effective non-surgical option for the treatment of facial expression wrinkles and in selected cases of facial asymmetry and finds more and more important indications in medical practice.

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Fig. 5a - Patient with facial paralysis of traumatic origin, mouth deviation and asymmetry of nasogenian furrow.

Fig. 5a - Paciente com paralisia facial de origem traumática, desvio da boca e assimetria do sulco nasogeniano.



Fig. 5b - Three months after application into zygomaticus and risorius muscles.

Fig. 5b - Três meses após a aplicação nos músculos zigomáticos e risório.



Fig. 6a - 50 year-old patient with congenital facial paralysis.

Fig. 6a - Paciente de 50 anos com paralisia facial congênita.

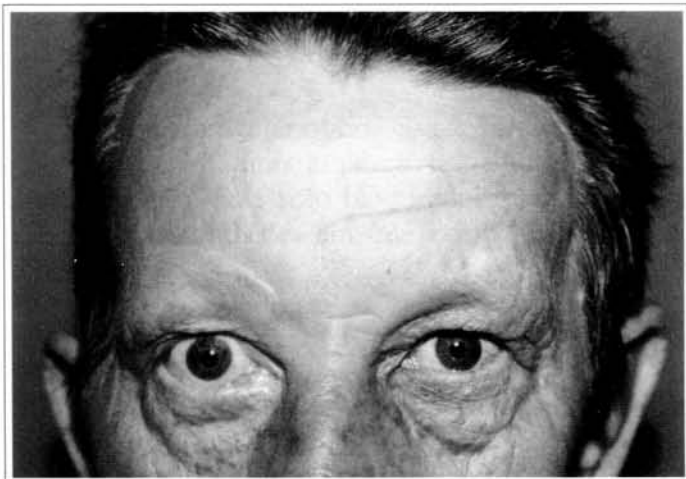


Fig. 6b - Five months after treatment with Botox.

Fig. 6b - Cinco meses após tratamento com Botox.

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