

The increasing popularity of Botox Injections

Zohra Zaidi

Department of Dermatology, Zainab Panjwani Hospital, Karachi.

It was only about 25 years ago, when an ophthalmologist, Dr Allen Scot for the treatment of strabismus, introduced botulinum toxin-A (Botox). Botox today has become a household name, and the treatment with botox is now a part of virtually every cosmetic and dermatology clinic in the United States.¹

Both men and women have spent large amounts of money to prevent the ravages of time. Today we have a long list of armamentarium to fight against the ageing process; these are both surgical and non-surgical procedures. Surgical procedures although more lasting, are time consuming, expensive, linked with postoperative complications. This led to the search of methods, which were non-invasive, simple, and quick in producing results and with minimal side effects. We have a long list of these procedures as botulinum toxin-A (Botox) injection, skin implants, chemical peels, microdermabrasion, laser resurfacing etc. Botox is indeed the most popular antiageing facial aesthetic today. Let us look into the insight of its popularity.

A German physician and poet Justinus Kerner first gave the full description of food-borne botulism from 1817-1822. He observed that the food poisoning was caused by the great economic hardship related to the Napoleonic wars; there was a decline in the hygienic measures of food production and handling. The illness became known as 'sausage poisoning', because it followed ingestion of spoiled sausage. The word botulism comes from the Latin word 'botulus', meaning sausage.² In 1919, Professor Burke at Stanford University isolated the first two toxins of *Clostridium botulinum*. Shortly after the Second World War, a purified form of the toxin was developed in a crystalline form. The interest of the toxin for therapeutic purposes began in 1949. It was much later in the 1970s when Allen Scot used it for treatment of strabismus; he also noticed its effect on wrinkles. Later Caruthers and Caruthers began pursuing the line of treatment for wrinkles.¹⁻³ Today Botox is used all over the world.

Botulinum neurotoxin is produced by the gram negative, anaerobic bacteria *Clostridium botulinum*. Eight types of *Clostridium botulinum* neurotoxin exist: A, B, C1, C2, D, E, F, and G.¹⁻⁴ All are proteases with a similar structure, composed of a light chain linked to a heavy chain by disulphide bond. Each is antigenically distinct and has a different site of action within the neuron. Botulinum toxin A

BTX-A (Botox) and botulinum toxin-B BTX-B (Myobloc) are used for cosmetic purpose.^{1,2,4} The toxin acts by paralyzing the muscles by chemical denervation. Neurotransmission at the neuromuscular junction involves the release of acetylcholine from the presynaptic nerve terminal. BTX-A is the toxin commonly used for the treatment of wrinkles. BTX-B has a faster onset of action than BTX-A, but its duration of action is shorter, and is more painful than BTX-A. BTX-B is used when the response to BTX-A is poor, or absent, perhaps due to the presence of antibodies to BTX-A.^{2,5}

Botulinum toxin A (BTX-A) acts on the wrinkles caused by hyperactive muscles, it will not act on the wrinkles caused by the loss of collagen and elastic tissue, nor will it act on the wrinkles caused by gravity. Knowledge of the muscles of facial expression, and the functional interaction between these muscles is an indispensable prerequisite for the botulinum toxin injection.

The effect of Botox lasts from 2-6 months. Once the chemical denervation begins, axon terminals form new unmyelinated sprouts, and the motor end plate region expands. After several months, the inactivated terminals slowly recover function, and the new sprouts and end plate regress. Recovery of inactivated terminals appears to be the basis of the loss of clinical effect after the Botox injection.²

The toxicity of Botox is expressed in biological mouse units (U), in which 1 unit equals the median lethal dose (LD50) of a group of Swiss Webster mice that weigh 18-22 gm each. The human LD50 for a 70 kg person has been calculated to be 3000 U. The amount used for cosmetic purpose is about 100 U, making poisoning by accidental overdose extremely unlikely. The amount used for therapeutic purpose ranges from 300-600 units.¹⁻⁴

Botox is used for both therapeutic and cosmetic purpose. It is used for the treatment of strabismus, blepharospasm, hemifacial spasm, spasmodic dysphonia, cervical dystonia, achalasia, hyperhidrosis, sialorrhoea, etc.²⁻⁵ For cosmetic purpose, it is used for the treatment of wrinkles, those due to hyperactive muscles.

Botox acts best on the wrinkles on the upper half of the face. In particular, the crow's feet, glabella (anger) lines, and the wrinkles on the forehead. Many muscles participate in the normal function of the mouth and cheeks. Botox

injected in the lower half of the face can result in an asymmetrical smile, inability to eat and speak properly; there is impaired function of the muscular masticatory apparatus.¹ Expert hands, preferably a plastic or dermatological surgeon should treat wrinkles on the lower half of the face.

Spacing of the injection is important; the injections should not be placed too close to the muscles where weakness is to be avoided. Ptosis of the eyelid or even double vision can occur through toxin diffusion. Patients are given specific instructions after a Botox injection to prevent this side effect.⁶

Many doctors prefer to inject Botox under electromyogram (EMG) monitoring. This technique allows the injector to inject at that part of the muscle contributing to most of the wrinkles. The right muscle at the right site is injected.

Sometimes untoward side effects can occur after correct relaxation of a target muscle. Injection in the glabella region can lead an exaggerated action of the opposing action of the frontalis muscle resulting in 'quizzical' or 'Mephisto' eyebrow.^{1,2,6}

The amount of Botox injected is also important, too much of the toxin can result in excessive weakening of the muscle e.g. complete paralysis of the frontalis muscle results in a 'heavy brow' feeling. Some important mimetic movements are impaired and expressivity is inhibited. Too little injection will not produce the desired result. The amount of Botox injected depends upon the thickness of the muscle, thickness of the skin. Men generally require a larger dose than women.^{2,3}

A few patients may complain of pain on injection, there may be slight bruising or haematoma formation. Some patients report transient headache after Botox injection. These side effects can be easily controlled by careful injection technique, use of ice or cooling device, an anaesthetic cream applied before the injection. The cause of transient headache is not known, it is of short duration and self-limited.⁶

Improvement in the wrinkles is usually noticed within 1-3 days following the injection; the effect is maximum by 1-2 weeks.¹⁻⁴ Some diffusion of the toxin may occur while injecting. Patients should strictly follow the instruction after Botox injection, so the toxin does not diffuse from the site of injection.

Contraindications to the injection of Botox include prior allergic reactions, pregnancy, lactation, diseases of neuromuscular junction transmission e.g. myasthenia gravis, drugs that interfere with neurotransmission as aminoglycosides, penicillamine, quinine, calcium channel blockers, local infection at injection site.²⁻⁵ Patients who are psychologically unstable or those who have unrealistic goals should also be excluded from the treatment.

Patient selection is very important. Injection of Botox in older patients should be done with care, as some facial muscles may be overactive to counteract the ageing process e.g. hyperfunction of the frontalis to overcome the

ptosis of the eyebrows seen in old age. It is important to recognize patients with excessive lower eyelid skin or lower fat pads prior to treatment, as these will benefit the least from Botox injection; these will need adjunctive cosmetic procedures as blepharoplasty.^{1,7,8}

The degree of wrinkles can be assessed by Glogaus photoageing classification, the skin elasticity tested by the snap test.⁸ Patients with advanced photoageing will need a combination of treatments as implants, laser resurfacing and lifting procedures. This should be discussed with the patient before the injection.

A number of people have facial asymmetry; this can become worse with Botox injection. Balance, harmony and unity are pillars in the concept of facial beauty. Do not inject if Botox injection is likely to increase the asymmetry. Patients, who extensively use the muscles of facial expression as actors and politicians, should be told of the decrease in expression before the treatment. The aim of treatment is not to give people an expressionless face.

It is advisable to take photographs of the patient at rest and during muscle contraction before the injections, and follow up photographs after 3-4 weeks. This will give an idea of the improvement done on the patient, and avoid any patient dissatisfaction.

The popularity of Botox increases by the day. In about 25 years of Botox therapy, there has been no record of death due to overdose.¹ There are innumerable advantages of Botox injection. Botox injections are very safe; no long-term side effects have been noticed, to date. Its effect is reversible; duration transient, easy mode of application, the action is targeted to the localized muscle, the effect is immediate.⁹

The safety of Botox injections lies in the hands of the injector, who should be well trained, must have a complete knowledge of the muscles of facial expression; their anatomy and physiology, how to dilute doses, inject proper amounts of toxin and in the right muscle. The complications and adverse reactions increase when inexperienced people inject Botox.

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