

## Section II

### Introduction to Neurotoxins

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# 3

## Neurotoxins Overview

### Action

Peripheral neuromuscular blocking agents.

### Mechanism of Action

Botulinum toxins irreversibly bind to the presynaptic terminal of the neuromuscular junction and prevent release of acetylcholine, thereby preventing muscle contraction.

### Botulinum Toxin A (BoNTA) Formulations

#### Botox: OnabotulinumtoxinA (BoNTA-ONA)

- 100 BU (Botox units) per vial (also contains 0.5 mg human serum albumin, 0.9 mg sodium chloride)
- Vacuum dried
- Store in freezer until reconstituted; refrigerate after reconstitution

#### Dysport: AbobotulinumtoxinA (BoNTA-ABO)

- 300 DU (Dysport units) per vial (also contains 0.125 mg human serum albumin, 2.5 mg lactose)
- Lyophilized
- Store in freezer until reconstituted; refrigerate after reconstitution

#### Xeomin: IncobotulinumtoxinA (BoNTA-INC)

- 100 XU (Xeomin units) per vial (also contains 1.0 mg human albumin, 4.7 mg sucrose)
- Lyophilized
- Store at room temperature; refrigerate after reconstitution

### Neuronox

- Approved in 2004 by the South Korean Ministry of Food and Drug Safety (MFDS), manufactured by Medy-Tox Inc. (Seoul, Korea)
- Not U.S. FDA-approved in the United States
- 50, 100, and 200 U vials available (100 U contains 0.5 mg human serum albumin and 0.9 mg sodium chloride)
- Lyophilized
- Conversion ratio appears to be 1:1 with Botox
- Store in freezer until reconstituted; refrigerate after reconstitution

### PurTox

- Pending FDA approval
- Similar to Xeomin without complexing proteins

**Table 3.1** Comparison of Botulinum Toxin A Formulations.

Product	Year of FDA Approval	Generic Name I	Composition	Manufacturer	Similar Product Trade Names	Dosing Ratio Compared with Botox
Botox	2002	OnabotulinumtoxinA	900 kD	Allergan Inc., Irvine, CA	Botox cosmetic, Vistabel, Vistabex	NA
Dysport	2009	AbobotulinumtoxinA	500–900 kD	Medicis Aesthetics Inc., Scottsdale, AZ	Reloxin, Azzalure	2.5–3:1
Xeomin	2011	IncobotulinumtoxinA	150 kD No complexing proteins	Merz Aesthetics Inc., Franksville, WI	Xeomeen, Bocouture	1–1.5:1
Neuro-nox	N/A	N/A	940 kD	Medy-Tox Inc., Seoul, Korea	Meditoxin, Cunox, Siax, and Botulift	1:1
PurTox	Pending	N/A	150 kD No complexing proteins	Mentor Corp., Santa Barbara, CA		1–1.5:1
CBTXA	N/A	N/A	900 kD	Lanzhou Biologics, Lanzhou, China	Prosigne, Lantox	?

Abbreviations: kD, kilodalton; N/A, not applicable.

## CBTXA

- Not FDA-approved in the United States
- The only botulinum toxin A registered with the Chinese government
- Lyophilized
- Contains 5 mg bovine serum albumin, 25 mg dextran, 25 mg sucrose per 100 units
- Conversion ratio to Botox unknown
- Store in freezer, refrigerate after reconstituted

## Botulinum Toxin B (BoNTB) Formulation

### Myobloc: BoNTB (rimabotulinumtoxinB)

- Solstice Neurosciences Inc., Malvern, PA
- Trade names: MyoBloc, NeuroBloc

- Minimal use cosmetically due to painful injection and limited duration
- FDA-approved only for cervical dystonia in adult

## Additional Reading

- [1] Flynn TC. Advances in the use of botulinum neurotoxins in facial esthetics. *J Cosmet Dermatol*. 2012; 11(1):42–50
- [2] Nettar K, Maas C. Neuromodulators: available agents, physiology, and anatomy. *Facial Plast Surg*. 2011; 27(6):517–522
- [3] Moers-Carpi M, Dirschka T, Feller-Heppt G, et al. A randomised, double-blind comparison of 20 units of onabotulinumtoxinA with 30 units of incobotulinumtoxinA for glabellar lines. *J Cosmet Laser Ther*. 2012; 14(6):296–303
- [4] Walker TJ, Dayan SH. Comparison and overview of currently available neurotoxins. *J Clin Aesthet Dermatol*. 2014; 7(2):31–39

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## Neurotoxin Preparation

Package inserts for the neurotransmitters state that they should be reconstituted with nonpreserved saline (0.9% sodium chloride). However, clinical practice has determined that using preserved saline (containing benzyl alcohol) results in much less patient discomfort.

Botox, Botox Cosmetic—100 BU (Botox units) may be reconstituted with

- 1 mL preserved saline, which produces a solution of 10 BU per 0.1 mL
- 2 mL preserved saline, which produces a solution of 5 BU per 0.1 mL
- 2.5 mL preserved saline, which produces a solution of 4 BU per 0.1 mL
- 4 mL preserved saline, which produces a solution of 2.5 BU per 0.1 mL

Xeomin—100 XU (Xeomin units) may be reconstituted and used similarly to Botox, above.

Dysport—300 DU (Dysport units) may be reconstituted with

- 2.5 mL preserved saline, which produces a solution of 12 DU per 0.1 mL
- 1.5 mL preserved saline, which produces a solution of 20 DU per 0.1 mL
- 1.0 mL preserved saline, which produces a solution of 30 DU per 0.1 mL

General conversion ratios

- 1 BU = 1.0 to 1.5 XU
- 1 BU = 2.5 to 3.0 DU

### Additional Reading

- [1] Bass Kaplan J. The dilution confusion: easy dosing for botulinum toxins. *Plast Surg Nurs*. 2016; 36(1):24–27
- [2] Moers-Carpi M, Tan K, Fulford-Smith A. A multicentre, randomized, double-blind study to evaluate the efficacy of OnabotulinumtoxinA (20 units) in the treatment of glabellar lines when compared to IncobotulinumtoxinA (30 units). *European Masters in Aesthetic and Anti-aging Medicine*, September 30–October 1, 2011, Paris

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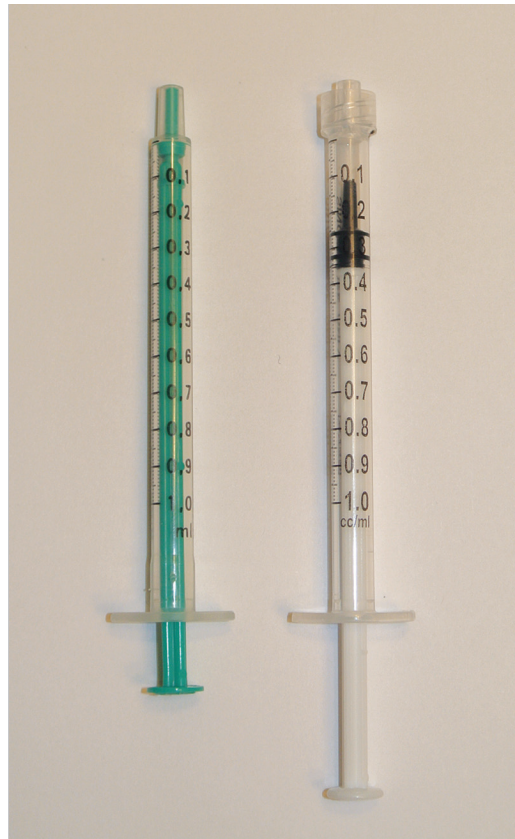
## Instrumentation for Neurotoxin Injections

After reconstitution, botulinum toxin A (BoNTA) can be injected using a 1-mL syringe with a 30-gauge needle. Product can be withdrawn from the vial with a 20-gauge needle, and a 30-gauge or smaller needle can then be used for injection. A “No Waste” syringe with or without a Luer lock (Acuderm Inc., Fort Lauderdale, Florida, or Exelint International, Los Angeles, California) is also available that pushes the last drop of product through the needle hub. Alternatively, non-drip insulin syringes (BD Ultra-Fine Needle, Becton Dickinson, Franklin Lakes, New Jersey) may be used. These syringes are available in 0.3 and 0.5 mL and have an attached 31-gauge, 8-mm needle.

When using these non-drip insulin syringes, the needle is pre-attached. The BoNTA must be reconstituted and the vial stopper removed. Neurotoxin is drawn up into each syringe and the syringes labeled with the product name, lot number, and expiration date. The syringes are stored in the refrigerator. Because the needles are so fine and fragile, care must be taken not to hit the vial with the needle tip while aspirating the product. In addition, the utmost care is required during re-capping of the needle (prior to patient use) to prevent damage or blunting of the fine needle tip.



**Fig. 5.1** Dripless 0.5 mL (left) and 0.3 mL (right) BD insulin syringes may be used for BoNTA injections. These syringes have a pre-attached 31-gauge needle.



**Fig. 5.2** "No Waste" syringe pushes plunger into needle hub: (left) Acuderm; (right) Exelint.