

Selection of Safe Parameters for Jet Injection of Botulinum Toxin in Palmar Hyperhidrosis

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We commend Dr Doft and her coauthors¹ on their excellent review article titled “Treatment of Hyperhidrosis With Botulinum Toxin,” but we wish to shed some light on the use of jet injection in the palmar skin because all jet injectors do not perform similarly, and even the same injector can perform differently in different body sites. For example, although the Dermojet (AKRA, Pau, France) is safe to use for plantar hyperhidrosis, its use for palmar hyperhidrosis can be hazardous. We would like to take this opportunity to elaborate on how to set safe parameters on the jet injector to prevent damage to underlying nerve and vessel structures.

In the reference on jet injection cited by the authors,² under the heading of palmar and plantar treatment, the device used was a low-pressure, CO₂-driven, versatile jet injector: the MED-JET MBX (Medical International Technologies, Montreal, QC, Canada³; Figure 1) and not the standard Dermojet,⁴ which is a high-pressure jet injector device with a fixed volume of 0.1 mL per spurt. The Dermojet is activated by a spring, which generates a fixed driving pressure close to 1422 parts per square inch (psi). On the other hand, the MED-JET MBX is equipped with an adjustable pressure system (120–300 psi) and an adjustable volume per spurt that ranges from 0.02 to 0.3 mL.

As mentioned by the authors, pain associated with injections for palmar and plantar hyperhidrosis can deter patients from undergoing botulinum toxin type A (onabotulinumtoxinA, BoNT-ONA; Botox; Allergan, Inc, Irvine, California) injections to the hands and feet. We praise the authors for including the jet injection option among the other traditional pain management measures. Jet injection can be defined as a needle-free drug delivery method in which a high-speed stream of fluid impacts the skin and delivers a drug.⁵ The fluid can be an anesthetic such as lidocaine,² BoNT-ONA,⁶ or any other medication. Eutectic mixtures of anesthetic creams, such as EMLA, must be applied an hour before a procedure and are not as effective on palmar and plantar skin. Lamarche et al⁷ reported that EMLA application is effective in easing the pain of electromyography needling in forearm skin but is ineffective when applied to the skin of the palmar surface of the hand. Jet injection of lidocaine has the advantage of providing immediate anesthesia on the skin surface. Moreover,



Figure 1. Versatile needle-free injector. MED-JET MBX (Medical International Technologies, Montreal, QC, Canada).

jet anesthesia prior to BoNT-ONA injection with a needle is preferred to direct injection of BoNT-ONA through the jet injector because direct jet injection of BoNT-ONA causes an approximate waste of 10% of the injectate through splash and splatter. Since this medication is very expensive, we prefer to inject lidocaine with the jet

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injector first and then introduce the BoNT-ONA with a needle. However, administration of BoNT-ONA through the jet injector can be particularly helpful for the needle-phobic patient.⁸

A review of the literature reveals that pain during jet injection remains a controversial issue: some studies claim that jet injection is painless, whereas others claim it is painful. Pain perception is usually assessed on a scale of 0 to 10, where 0 is absence of pain and 10 is the worst imaginable pain. A pain score of 3 is considered to be the boundary between mild and moderate pain.⁹ Zsigmond¹⁰ observed that 0 pain scores were consistently observed in more than 100 000 persons who received jet injection of lidocaine (jet-anesthesia), whereas other investigators have stated that jet injection is more painful than traditional needle injection.¹¹

Controversies pertaining to the severity of pain during jet injection reported in the literature stem from the fact that different parameters are used in various studies. As the full details of these parameters are not always available, it is hard to objectively compare their results. Jet injection parameters include the volume per spurt (a larger volume causes more pain), the driving pressure (a higher pressure setting can induce more pain and damage to the underlying nerve and vessel structures), the diameter of the orifice of the nozzle (a wider orifice causes more pain and deeper penetration), and the distance from the tip of the nozzle to the skin surface (a shorter distance causes more pain and deeper penetration). Furthermore, skin properties differ not only from one person to another but also from one site to another. The average thickness of the epidermis is 0.1 mm, but this can vary from 0.04 mm on the eyelids to 1.6 mm on the palms. Any traditional jet injection device with a fixed pressure, like the Dermojet, cannot work universally on different areas of the body. Mitragoti¹² reported that traditional jet injectors may cause pain due to the jet's deeper penetration level. Wolf et al¹³ reported that a driving pressure above 435 psi could cause considerable harm to the skin and underlying structures. Naumann et al¹⁴ used the Dermojet safely to inject BoNT-ONA directly into the skin for plantar hyperhidrosis but did not advocate for its use in palmar hyperhidrosis for fear of damaging vital superficial nerves and vessels. Vadoud-Seyed et al^{6,15} also treated plantar hyperhidrosis with direct injection of BoNT-ONA via the Dermojet but did not recommend the technique for palmar use.

Details of the jet injection technique for the hands and feet with a versatile jet injector have already been reported.^{16,17} The volume per spurt is set to 0.1 mL or less, and the pressure is adjusted to 120 psi and gradually increased by increments of 10 psi until a visible subepidermal wheal is obtained. This is an important safety issue because by increasing the pressure gradually, we avoid any injury to the superficial vessels and nerves lying under the skin of the palm. It is worthwhile mentioning that the average pressure used to induce a wheal is about 140 psi with a versatile jet injector, a pressure setting 10 times lower than that of the fixed 1442 psi pressure of the Dermojet.

Administration of needle-free anesthesia with a versatile jet injector prior to BoNT-ONA injection with a needle

has been performed at our office since 2004. The procedure has been applied successfully on more than 500 patients. Many of these patients return for yearly injections. Of note, we prefer to use 33-gauge needles instead of 26- or 30-gauge needles to reduce or eliminate the backflow of BoNT-ONA that may occur after each injection. Because the jet injector we use is CO₂ driven, we can induce as many anesthetic wheals as we want. We choose to stop after inducing 4 wheals because we use small volumes of 0.03 to 0.1 mL per spurt. Wheals induced with smaller volumes disappear in a shorter amount of time. Larger volumes per spurt persist much longer, but as our aim is to use the smallest total amount of lidocaine, we keep the volume per spurt at a strict minimum. Lately, we have also had success with injecting BoNT-ONA directly into the palmar skin. The procedure was almost painless and lasted close to 1 minute. A video of the procedure is available at http://hyperhidrose.ca/media/direct_btx_injection_for_palmar_hh/index.html.

We plan to publish a full report on this case shortly.

Disclosures

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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