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Case Report

Use of Botulinum Toxin Injections in the Treatment of Cold Intolerance

Kohila Vani Sigamoney, MBChB, MD, * Shetha Naji, MBChB, BSc, * Zahid Hassan, BM, MD, Dip Hand Surg (Br), * Paul McArthur, MBBS, PhD *

* Whiston Hospital, Prescot, United Kingdom

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There is currently no consensus on the treatment of cold intolerance in extremities in post-trauma patients. We aim to present two cases where botulinum toxin type A injections were used to improve symptoms of cold intolerance. Botulinum toxin type A (Allergan) was injected into the area around the palmar digital neurovascular bundle on both sides of the affected finger. We performed this in two patients, and both had good improvement of symptoms. One patient was discharged, and the other remained under routine follow-up with potential yearly botulinum injections to aid symptoms during the winter months. Both patients are pleased with their outcomes and report significant improvement from the low-risk treatment. In both described cases, injections of botulinum toxin had a significant effect on their symptoms. We conclude that botulinum toxin type A may be used as a treatment modality to improve symptoms of cold intolerance after trauma.

Cold intolerance in extremities is a common issue reported by many. It is defined as sensitivity to cold temperatures that may result in pain, numbness, tingling, weakness, or color changes of the effected extremity.[1] There may be one symptom alone or a combination of symptoms and commonly occurs after upper extremity trauma with a varying prevalence. Graham and Schofield[2] reported that in a worker's compensation cohort, more than 90% of patients in the trauma group and 59% to 69% of patients in the nontrauma group reported cold intolerance.

Cold intolerance does not always develop in the same or similar injuries and is not based on the severity of injury. Understanding the etiology is challenging, but the most widely accepted theory links the condition to disorders in extremity circulation.[3] Nylander et al[4] found that changes in finger vasoregulation were associated with symptoms in cold intolerance. In replanted fingers, single artery anastomosis was linked to higher chances of developing or suffering more with cold intolerance.[5] It may develop 6 months after injury and has been found not to improve in the following 6 months. Vaksvik et al[6] reported decrease in cold hypersensitivity between 1 and 2 years and 2 and 3 years.

To date, there is no consensus on the treatment of cold intolerance. There have been reports on improvement of symptoms with time. Graham and Schofield[2] reported, however, that on the contrary, 50% of cases worsened over time, and only 9% improved. It is important to note that this was for a worker's compensation cohort.

If we look at Raynaud's phenomenon, it is also a condition that involves decreased extremity circulation due to vasospasm triggered by cold or stress.[7] Learning from treatment experience of Raynaud's phenomenon, botulinum toxin A injections have been described to be beneficial.[7–9]

We present two cases where botulinum toxin type A injections were used to improve symptoms of cold intolerance.

Consent

Documented informed consent was obtained from the patients for publication of this case report. No patient identifying information or images have been included.

Injection site and dose

Botulinum toxin type A (Allergan) was injected into the area around the palmar digital neurovascular bundle on both sides of the affected finger in the region of the sympathetic plexus (see Fig.). Ten units were injected into each point.

Corresponding author: Kohila Vani Sigamoney, MBChB, MD, Whiston Hospital, Warrington Road, Prescot L35 5DR, United Kingdom.
E-mail address: kohilavani_sigamoney@yahoo.com (K.V. Sigamoney).

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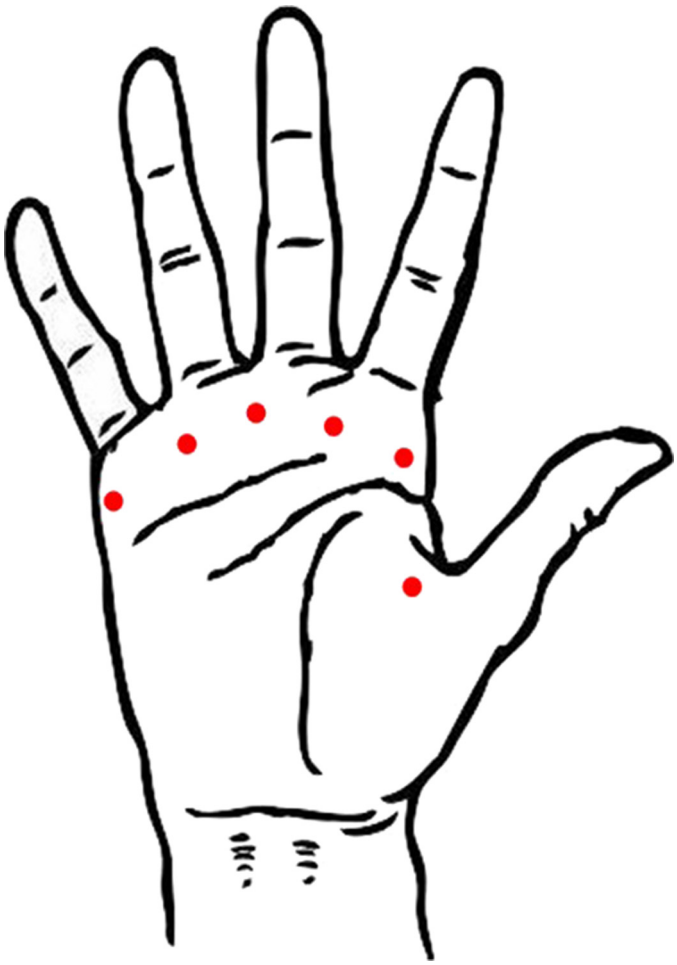

Figure. Image of a hand showing points of injections for treatment (dotted red points). Injection points depend on the finger affected.

Case Report

Case 1

Case 1 was of an 11-year-old girl who sustained a crush injury to the tip of her left middle finger 2 years prior (2018). A nailbed repair was performed. She reported hypersensitivity to the finger to the degree that she would not permit her mother to cut her nail on the finger. The tip of her finger was also white in the cold. A slight deformity to the fingertip was noted with asymmetry of the nail, albeit with good range of movement.

Upon review, she had discomfort and sensitivity to light touch over the dorsum of the distal phalanx at the base of the nail plate. She underwent a desensitization program but was noncompliant because of discomfort. She subsequently underwent botulinum toxin injection to the digit (20 units) in 2021. She reported good improvement of her symptoms, especially of the whitish coloration.

Case 2

Case 2 was of a 52-year-old man who sustained a crush injury to his left index finger 2 years prior (2016) sustaining a fracture of the middle phalanx. He had conservative treatment within a splint, resulting in a good range of movement with no neurological deficit. He developed vasospastic symptoms, which were only present when cold. He tried massaging his finger and wearing gloves, but this did not alleviate his symptoms. He also trialed nifedipine but could not tolerate the medication. He experienced numbness and general discomfort from the proximal interphalangeal joint onward. He was left hand-dominant and reported a medical history of hypertension, for which he takes ramipril.

Upon review in 2018, this was diagnosed as cold intolerance, and he trialed botulinum toxin injections. The first injection improved his symptoms significantly by 80% (patient's assessment). He had a further injection of 20 units, a year later, to help him through the winter months. The patient found it very beneficial, and we have agreed to plan annual botulinum injections each autumn, as needed.

Discussion

These two cases highlight that cold intolerance is caused by trauma. Iorio et al[10] explained the mechanism of action of botulinum toxin A. It is produced by the bacterium *Clostridium botulinum*, typically used for the treatment of specific muscle spasms. At the time of first commercial availability, it was known as Botox (Allergan, Inc). The mechanism of action is blockade of neurotransmitter release, that is, inhibition of acetylcholine vesicle released at the neuromuscular endplate, which decreases muscular tone by inhibiting smooth muscle vasoconstriction.[8] Vascular smooth muscle is affected by two additional mechanisms: blockade of transmission of norepinephrine vesicles preventing sympathetic vasoconstriction of vascular smooth muscle and via blocking the recruitment of specific α_2-adrenoceptor (α 2c), decreasing the activity of chronically upregulated C-fiber nociceptors leading to reduction in cold-induced vascular smooth muscle constriction and pain.

Based on this explanation, botulinum toxin produces a temporary digital sympathetic blockade, enabling reduction in symptoms of cold intolerance. In both described cases, the injections made a significant difference to the patient's symptoms. We conclude therefore that botulinum toxin type A may be used to improve symptoms of cold intolerance after trauma. With no complications in either case and an easily available treatment, the risk-to-benefit ratio is in favor of treatment and should be considered in the management of such patients. Both our patients did not report any side effects.

Based on our experience, although further experience and longer-term follow-up is required, we conclude that botulinum toxin injections may offer a role in the treatment of cold intolerance symptoms.

Conflicts of Interest

No benefits in any form have been received or will be received related directly to this article.

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