Case Report

Lumbar Sympathetic Block with Botulinum Toxin Type B for Complex Regional Pain Syndrome: A Case Study

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Lumbar sympathetic block (LSB) is an effective method for relief of sympathetically mediated pain in the lower extremities. To prolong the sympathetic blockade, sympathetic destruction with alcohol or radiofrequency has been used. The pre-ganglionic sympathetic nerves are cholinergic, and botulinum toxin (BTX) has been found to inhibit the release of acetylcholine at the cholinergic nerve terminals. Moreover, BTX type B (BTX-B) is more convenient to use than BTX type A. Based on these findings, we performed LSB on the 2 patients with complex regional pain syndrome (CRPS) in the lower extremity. Levobupivacaine 0.25% 5 mL mixed with BTX-B 5,000 IU was given under fluoroscopic guidance. Two months after LSB with BTX-B, pain intensity and the Leeds assessment of neuropathic symptoms and signs (LANSS) score were significantly reduced. Allodynia and coldness disappeared and skin color came back to normal. In conclusion, BTX-B can produce an efficacious and durable sympathetic blocking effect on patients with CRPS.

Key words: Botulinum toxins, complex regional pain syndrome, chemical sympathectomy, sympathetic ganglia

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Lumbar sympathetic block (LSB) is performed by percutaneous injection of local anesthetic around the lumbar sympathetic ganglia and results in a temporary sympathectomy to treat chronic pain in the lower extremity (1). LSB is used to treat sympathetically maintained pain status like phantom limb pain, post-stroke pain, and chronic regional pain syndrome (CRPS) type I and type II (2). To prolong the sympathetic blocking effect of LSB, sympathetic destruction using chemicals or radiofrequency lesioning has been used (3). The effects of chemical sympathectomy—using alcohol or phenol—last until the destroyed sympathetic chain regenerates (about 3 to 6 months); the effects of radiofrequency thermal ablation last up to a year (4). Other reviews on the subject of sympathetic destruction question the effectiveness of procedures. Furlan and colleagues (5) concluded that chemical sympathectomy for neuropathic pain has, at best, a temporary effect. Straube et al (2) concluded that there is little evidence of note supporting surgical and chemical sympathectomy for neuropathic pain and CRPS. Another potential problem with sympathetic destruction is that when chemicals or radiofrequency are used, pain mediators are released, which can result in sensitization (6). Chemical agents or radiofrequency can result in substantial increases in new neuralgic pain or postsympathectomy neuralgia (7,8); also, surgical sympathectomy is known to produce postsympathectomy neuralgia (9,10). Although these reports are based on the results of surgical sympathectomy, it is well known that sympathetic destruction can cause adverse effects.

Botulinum toxin (BTX) inhibits the release of acetylcholine at the cholinergic nerve terminals (11). Because the pre-ganglionic sympathetic nerves are cholinergic, BTX can be used in the sympathetic block (12).

Currently, there are no reports on the use of BTX type B (BTX-B) for LSB in patients with CRPS. BTX-B is more convenient to use than BTX type A (BTX-A). BTX-A is a powder formulation that is used after mixing 0.9% normal saline solution, which should be used within 4 hours. BTX-B, on the other hand, is a liquid formulation—thereby avoiding the problem of lyophilization—and has a long-term stability at refrigerated temperatures of 2 – 25°C (13). We performed LSB using BTX-B and found prolonged duration of analgesic effects of LSB. Here, we report on 2 cases involving CRPS patients who were well managed with LSB using BTX-B.

Case Presentation

Case 1

A 21-year-old man was referred to our pain center because of persistent pain and swelling of the left ankle. About 3 months previously he had sprained his left ankle and wore a brace on his lower leg for 10 days. The pain intensity was 8/10 at rest (10/10 on walking) on the visual analog scale (VAS) score and the Leeds assessment of neuropathic symptoms and signs (LANSS) score was 24/24. The patient reported persistent pain with burning sensation, allodynia, and hyperalgesia. Differences in skin color and temperature were noted between the left and right ankle. The left ankle was colder and more congested than right ankle (Fig. 1A); thermography showed that the body temperature of the left ankle was 2.35°C lower than that of the right ankle. The 3-phase bone scan test showed increased radioisotope uptake over the bilateral malleolar area of the left ankle in flow, pool, and delayed phases. The electromyography was normal and the autonomic nervous system test indicated that the abnormal electrophysiological activity in sympathetic skin response suggested autonomic dysfunction. The patient was diagnosed with CRPS type I according to the Budapest criteria (14).

The patient received lumbar epidural and caudal blocks but there was little effect after the procedures. We decided to block the left lumbar sympathetic plexus with local anesthetics. After receiving written consent from the patient, we accessed a venous route and administered Hartmann's solution. The patient was in a prone position with sterile skin preparation and draping. After 1% lidocaine was infiltrated around the entry point, a 21-gauge, 15 cm Chiba needle (Cook Inc., Bloomington, IN, USA) was advanced toward the left sympathetic plexus at the L3 level under fluoroscopic guidance. Contrast media was used to check correct positioning of the needle (Fig. 2) and 0.25% levobupivacaine (Chirocaine®, Abbott, Elverum, Norway) 5 mL was injected. The increased temperature of

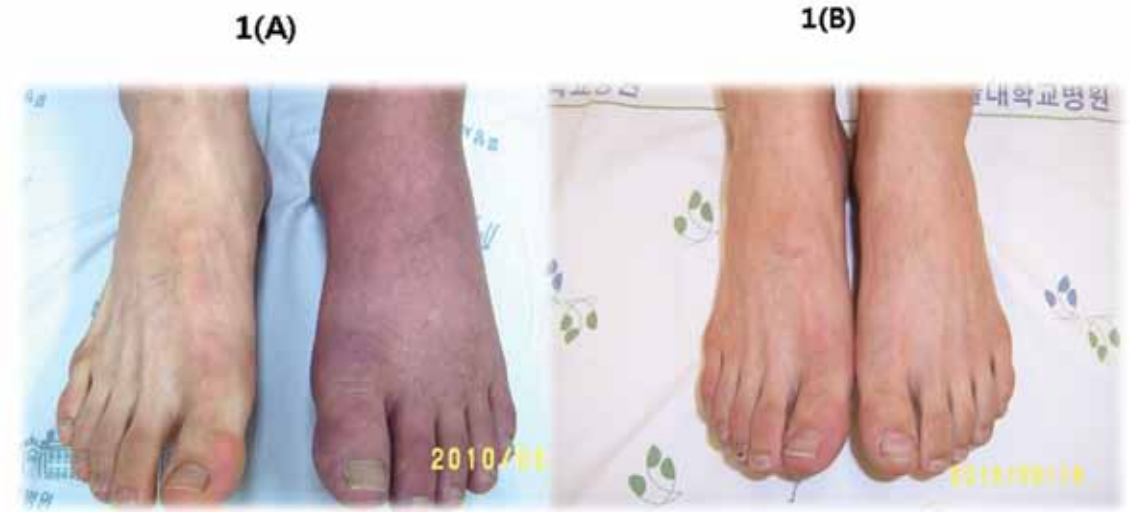

Fig. 1. *Case 1 Skin color change before the lumbar sympathetic block (LSB) with botulinum toxin type B (BTX-B). Two months after LSB with BTX-B. Skin color and turgor normalized.*

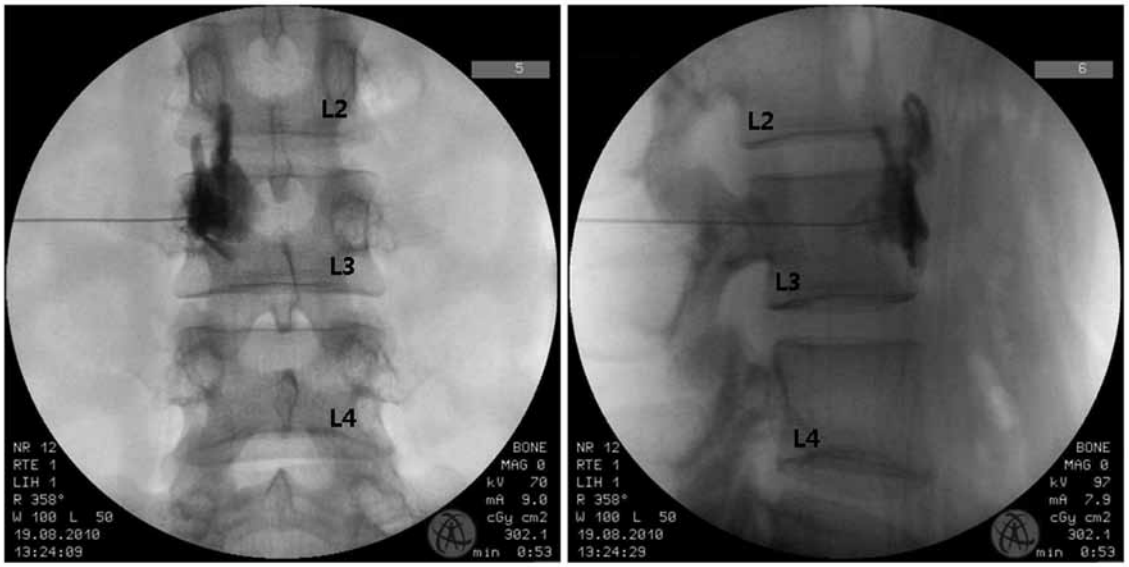

Fig. 2. *Lumbar sympathetic block with 0.25% levobupivacaine 5 mL.*

the left lower leg confirmed the success of the sympathetic block.

Two weeks after the LSB, the patient reported that his pain intensity decreased to 2/10 (3/10 on walking) on the VAS score for 5 hours following the procedure. Therefore, we repeated LSB—again under local anesthetics—with 0.25% levobupivacaine 5 mL. Two weeks after this second LSB procedure, the patient reported that his pain intensity decreased, however he wanted the analgesic effect to last longer. Therefore, we performed LSB for the third time with 0.25% levobupivacaine 5 mL mixed with BTX-B (Myobloc®, Solstice Neurosciences, USA) 5,000 IU. Two months after the third LSB (with BTX-B), the patient reported that his pain intensity had decreased to 1/10 at rest (2/10 on walking) on the VAS score and 3/24 on the LANSS score. Allodynia, hyperalgesia, and coldness disappeared and the skin color of the patient's ankle returned to normal (Fig. 1B). The follow-up thermography showed that the body temperature difference between the left and right ankle was down to 0.20°C (Fig. 3). The amount of medication was decreased; the patient did not required opioid or tramadol for pain control. There were no adverse effects from the injection of the BTX-B. Currently, the patient can walk without pain and no further follow-up visit is scheduled.

Case 2

A 22-year-old man visited our pain clinic for treatment of left lower leg pain. Seven months previously he had sprained his left ankle playing football. The patient wore a cast for 5 weeks and a short leg splint for 2 weeks to stabilize the ankle. Thereafter, his left lower leg became congested and edematous (Fig. 4A). He experienced burning, throbbing, stabbing, lancinating, and electric shock-like pain in his left leg. The pain intensity was 6/10 at rest (9/10 on walking) on the VAS score and 24/24 on the LANSS score. The patient's range of motion was limited because of the severe pain, which was aggravated by walking and sensitive to the touch. Trophic changes were seen on the left toe nails. Thermography showed that the body temperature of the left ankle was 3.4°C lower that of the right ankle. The 3-phase bone scan test showed asymmetric uptake of radioisotope in left foot. The autonomic nervous system test indicated that the abnormal electrophysiological activity in sympathetic skin response suggested autonomic dysfunction. The patient received lumbar epidural and caudal blocks, but there was little effect after the procedures. We performed a left lumbar sympathetic plexus block using the same local anesthetics as previously described in case 1. The patient wanted the analgesic effect to last longer. Therefore, we de-

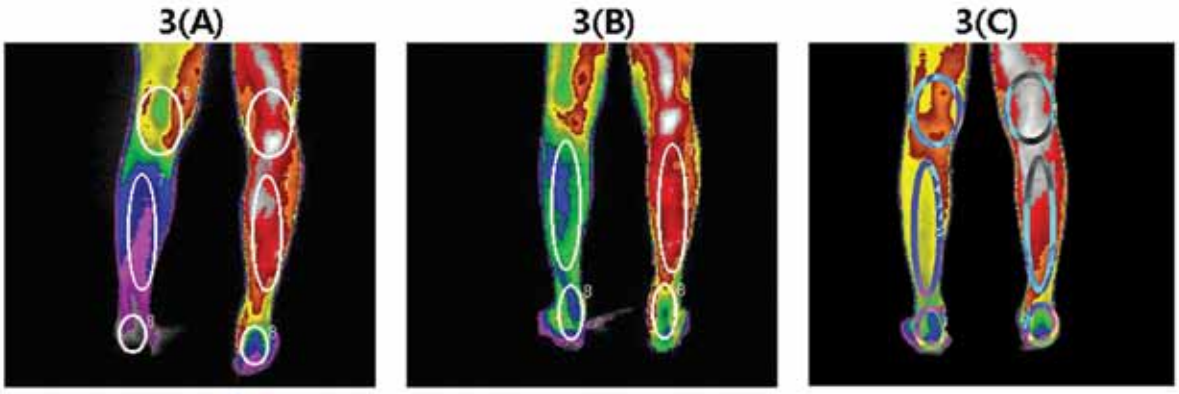

Fig. 3. Skin temperature change before and after lumbar sympathetic block with botulinum toxin type B in the case 1 patient. Before the procedure, the affected limb was colder than the unaffected limb by 2.35°C. Two weeks after the procedure, the affected limb was colder than the unaffected limb by 0.81°C. Two months after the procedure, the maximal temperature difference is only 0.2°C.

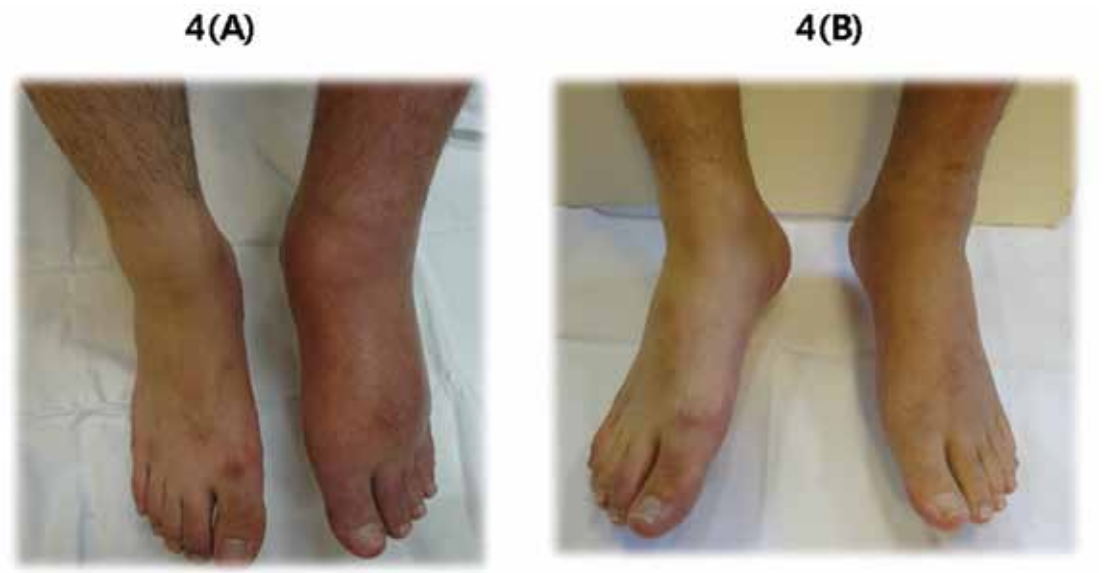

Fig. 4. *Case 2 Skin color change before the lumbar sympathetic block (LSB) with botulinum toxin type B (BTX-B). One month after the second LSB with BTX-B, skin color and turgor normalized.*

cided to perform lumbar sympathetic plexus block with 0.25% levobupivacaine 5 mL plus BTX-B (Myobloc®, Solstice Neurosciences, USA) 5,000 IU as described in case 1. Two months after the procedure, the VAS score decreased to 3/10 at rest (4/10 on walking). Two months after the second LSB with BTX-B, an third LSB with BTX-B was performed because of the ongoing problem with coldness in his left leg. One month later the procedure, the coldness was much improved and the pain intensity was to 2/10 at rest (3/10 on walking) on the VAS score and 8/24 on the LANSS score. Allodynia, hyperalgesia, and coldness disappeared and the skin color of his left leg returned to normal (Fig. 4B). The amount of medication decreased; opioid and tramadol were not required after the procedures. The patient did not suffer any adverse effects from injection of BTX-B. The

outcome was satisfactory and the patient is receiving follow-up observation.

Discussion

This report presents 2 cases of successful treatment outcome after LSB with BTX-B in patients with CRPS. CRPS is a debilitating condition that is characterized by pain disproportionate to an anticipatory injury, vasomotor changes, and occasionally trophic or motor function changes (15). These changes are known to be related to neuronal dysfunction, especially in the sympathetic nervous system (7).

LSB is performed by percutaneous injection of local anesthetic around the lumbar sympathetic ganglia to treat sympathetically maintained pain (1,7). The duration of the LSB is temporary (12), therefore it is necessary to prolong the sympathetic blocking effect to manage the sympathetically maintained pain.

BTX prevents the release of acetylcholine from cholinergic nerve terminals. It acts by blocking the docking and fusion of soluble N-ethylmaleimide sensitive factor attachment protein receptor (SNARE) proteins at the neuromuscular junction (16). There are 7 serologically distinct toxin types named A, B, C, D, E, F, and G (11). Different types of BTX block different proteins of the SNARE protein complex. Different targets of the SNARE protein complex affect potency and duration of action of BTX (16). Preganglionic sympathetic nerves are cholinergic, and animal data indicate that BTX can induce prolonged sympathetic block when placed on surgically exposed sympathetic ganglia (17). The action of BTX is long-lasting but not permanent, and it does not result in cytotoxicity or neural loss (17).

Several reports have been published on the use of BTX-A in the treatment of pain related to headaches, lower lumbar pain, myofascial pain syndrome, and CRPS (18). Carroll et al (12) performed LSB with BTX-A in 9 patients with CRPS and concluded that BTX-A provided prolonged analgesia after sympathetic blocks; the median duration until analgesic failure was 71 days in the BTX-A group, compared with 10 days in bupivacaine group.

In the study for comparison of efficacy, safety, and duration between BTX-A and B in toxin naïve patients with cervical dystonia, the median duration of effect was not different (13.1 vs 13.7 weeks). Also, there was no significant difference in injection site pain and dysphagia between BTX-A and B. Only mild dry mouth showed higher incidence in BTX-B (19).

We used BTX-B instead of BTX-A in the 2 cases reported here. With the mild side effects of BTX-B, it has not only convenient for clinical use but can also be used for managing patients with BTX-A resistance. Resistance to BTX-A exhibits a higher incidence when higher dosages are injected (20). According to recent research, a total of 5 patients resistant to BTX-A have been observed in 10,000 injections (21). Patients who showed poor response after BTX-A injection may have had neutralizing antibodies (22, 23). It is known that antibodies against BTX-A do not have any effect on BTX-B (24). Therefore, BTX-B can be used efficaciously in patients that are BTX-A resistant. Patients in this report showed positive outcomes of LSB with BTX-B. The reasons for spontaneous resolution in these 2 patients can be due to a relatively short CRPS duration and cumulative effects of other therapies. However, we wanted to describe the usability of BTX-B as an alternative to sympathetic destruction with chemicals or with radiofrequency for the treatment of CRPS in this case report.

Conclusion

We conclude, therefore, that BTX-B can produce efficacious and durable LSB. Further prospective, double-blind, randomized studies are required to thoroughly document the utility of the procedure.

Disclaimer

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Conflict of interest

Each author certifies that he or she, or a member of his or her immediate family, has no commercial association (i.e., consultancies, stock ownership, equity interest, patent/licensing arrangements, etc.) that might pose a conflict of interest in connection with the submitted manuscript.

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