

# Long-Term Functional Recovery Following Botulinum Toxin Type A for Gastrocnemius Hypertonia After Lumbar Laminectomy: A Case Report

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## Abstract

**Background:** Focal muscle hypertonia/spasticity can complicate recovery after spinal surgery, limiting mobility and function. Botulinum toxin type A (BoNT-A) reduces acetylcholine release at the neuromuscular junction and is an established, targeted therapy for focal spasticity when combined with rehabilitation.

**Case:** A 23-year-old man developed painful spasms and focal hypertonia of the right gastrocnemius after L2–L3 laminectomy. Ultrasound-guided BoNT-A was administered to the medial (25 U) and lateral (12.5 U) heads, followed by a structured rehabilitation program.

**Outcomes:** The patient showed rapid improvements in pain, modified Ashworth scale (MAS), ankle dorsiflexion, and gait within two weeks; he resumed light jogging by three months. At two years, he reported full return to running and gym activities without reinjection and no adverse effects.

**Conclusion:** In this postoperative context of focal gastrocnemius hypertonia, BoNT-A plus rehabilitation was associated with sustained pain relief and functional recovery over two years, supporting individualized, multidisciplinary spasticity management.

## Introduction

Postoperative hypertonia and spasticity can hinder gait restoration after spinal procedures when neural elements are irritated or recovery is prolonged. BoNT-A acts by reversibly inhibiting acetylcholine release through cleavage of SNARE proteins at cholinergic terminals, producing a focal chemodenervation that peaks over 1–2 weeks and typically lasts 3–4 months. Across neurologic etiologies, randomized and real-world evidence supports BoNT-A for lower-limb spasticity, including plantarflexor overactivity affecting gait. Guidance statements emphasize goal-directed dosing and muscle selection alongside rehabilitation to optimize function. Ultrasound or electrical stimulation guidance enhances injection precision compared with landmark methods for triceps surae.

**Case Presentation**

**Patient Information**

A 23-year-old previously healthy male (history notable only for irritable bowel syndrome) presented with acute low back pain and right-sided radiculopathy that progressed over one week to the point of limited ambulation. No trauma, constitutional symptoms, or sphincter dysfunction were reported.

**Clinical Findings**

Neurological examination demonstrated a right L4 sensory deficit, reduced strength in right hip/knee muscle groups, positive straight-leg raise at 40° on the right, and painful spasm with hypertrophy of the right gastrocnemius. There were no signs of wound infection or myelopathy.

**Timeline**

Date	Event
Apr 21	ER presentation with back pain and radiculopathy
Apr 24	L2–L3 laminectomy
May 1	Discharged after initial rehab assessment
Jul 9	Outpatient review: right gastrocnemius focal hypertonia observed
Jul 15	BoNT-A injection: medial head 25 U; lateral head 12.5 U (ultrasound-guided)
Jul 30	Marked symptom relief; improved gait and ankle ROM
3 months	Functional stretching; light jogging
1 year	Moderate physical tasks tolerated; minimal stiffness only
2 years	Full return to running/gym; no recurrence; no reinjection

## Diagnostic Assessment

Ultrasound revealed right medial gastrocnemius hypertrophy ( $\approx 1.3$  cm vs 0.8 cm contralaterally). Spasticity measured MAS 1+ at the ankle plantarflexors. Pain was VAS 6/10 pre-injection. Passive ankle ROM was full with end-range pain; active dorsiflexion was limited by overactivity. Post-injection manual muscle testing showed at least a two-grade improvement in dorsiflexors and plantarflexors.

## Therapeutic Intervention

Under ultrasound guidance, BoNT-A was infiltrated into the medial (25 U) and lateral (12.5 U) heads of the gastrocnemius. Post-injection rehabilitation comprised daily gastrocnemius–soleus stretching, progressive neuromuscular re-education (ankle strategy and closed-chain control), and gait retraining emphasizing controlled tibial progression and terminal stance.

## Follow-Up and Outcomes

Short-term (1 month): Pain decreased to VAS 1–2/10; MAS improved; dorsiflexion strength and spatiotemporal gait parameters improved; standing calf stretching became pain-free.

Intermediate (3–12 months): Gradual resumption of sport; no recurrence of spasms; occasional tightness only after prolonged activity.

Long-term (2 years): Full return to running and resistance training; single-leg hop symmetric bilaterally; no reinjection required; no adverse events were reported.

## Discussion

This case highlights a post-laminectomy context of focal gastrocnemius hypertonia successfully addressed with targeted BoNT-A plus rehabilitation, with sustained recovery at two years. Although most BoNT-A evidence arises from post-stroke or other upper motor neuron syndromes, its mechanism and goal-directed application are consistent across etiologies when focal overactivity limits function. Precise targeting of the gastrocnemius heads under ultrasound likely enhanced localization and response compared with landmark techniques, while pairing injections with rehabilitation is recommended to translate tone reduction into functional gains. For mild spasticity (MAS 1+), a relatively low total dose confined to the target muscle can minimize spread and adverse effects while allowing active retraining. BoNT-A effects typically last 3–4 months, but functional benefits may persist with ongoing rehabilitation or repeated cycles when indicated. In this case, durable recovery without reinjection may reflect early correction of aberrant motor patterns and improved strength, although this hypothesis requires prospective validation.

## Conclusion

In a young adult with post-laminectomy focal gastrocnemius hypertonia, ultrasound-guided BoNT-A combined with structured rehabilitation was associated with rapid symptom relief and sustained, reinjection-free functional recovery at two years. This case supports individualized, multidisciplinary spasticity management and judicious BoNT-A use outside traditional post-stroke indications.

## Patient Perspective

“The treatment made a huge difference. I went from being unable to walk without pain to running again. I feel completely back to normal now.”

## Informed Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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