



# Impact of focal hand dystonia on hand function—a case report with carpal tunnel syndrome and mirror dystonia video

Francisco José Gallego-Peñalver<sup>1,2,3</sup> · Silvia Beatriz Romero-de-la-Higuera<sup>4</sup>

<sup>1</sup> Departamento de Fisiatría y Enfermería, iHealthy Research Group, IIS Aragón, Universidad de Zaragoza, Zaragoza, Spain

<sup>2</sup> Rehabilitation Department, Hospital Obispo Polanco, Teruel, Spain

<sup>3</sup> Neurorehabilitation Unit, Rehabilitation Department, Hospital Universitario y Politécnico La Fe, Valencia, Spain

<sup>4</sup> Rehabilitation Department, Hospital Comarcal Francesc de Borja, Gandia, Spain

## Abstract

**Background:** Focal hand dystonia is a movement disorder that causes involuntary and painful contractions in the muscles of the forearm and hand, affecting fine manual dexterity and activities such as playing instruments or writing. In contrast, carpal tunnel syndrome is a neuropathy that leads to tingling and weakness in the hand due to compression of the median nerve.

**Case presentation:** We present the case of a woman with a clinical history of compressive syndrome of the median nerve of 2 years' duration and a diagnosis of focal dystonia of the flexor pollicis longus. Botulinum toxin injections were administered, resulting in an improvement of symptoms.

**Clinical discussion:** Despite the improvement from botulinum toxin treatment, carpal tunnel release surgery could not be avoided due to the persistent involvement of the median nerve. Botulinum toxin injection appears to be a useful treatment in such cases and may help to manage symptoms effectively if applied early.

**Conclusion:** In this case, early administration of botulinum toxin might have improved the patient's quality of life by delaying or avoiding the need for surgery, underscoring the importance of timely diagnosis and intervention.

## Keywords

Focal Hand Dystonia · Neuromuscular disease · Median nerve · Botulinum toxin · Multidisciplinary pain clinics

## Video online

The online version of this article contains one video. The article and the video are online available at <https://doi.org/10.1007/s00337-025-01163-4>. The video can be found in the article back matter as "Electronic Supplementary Material."



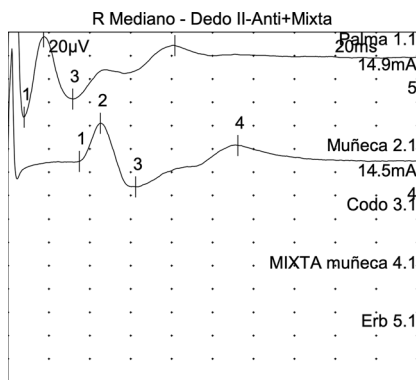
Scan QR code & read article online

## Introduction

Focal hand dystonia and carpal tunnel syndrome (CTS) are two disorders that affect hand and wrist function.

Focal dystonia is a movement disorder characterized by involuntary and painful muscle contractions in specific areas of the body. Focal hand dystonia, also known as hand spasm dystonia, is a movement disorder that causes involuntary and painful contractions in specific muscles of the forearm and hand [1]. These contractions can

be severe enough to interfere with everyday activities and fine motor movements, such as writing, playing musical instruments, or performing manipulative tasks. Symptoms may vary and include involuntary and spasmodic muscle contractions in the forearm and wrist, pain in the forearm and palm of the hand, difficulty performing precision movements, tremors, stiffness, muscle fatigue, or a sensation of stiffness [2]. The exact cause of focal hand dystonia is unknown, but it is believed to be related to a combination of genetic,



**Fig. 1** ▲ Sensory neurophysiological study of the median nerve confirming signs of focal neuropathy at the carpal tunnel level with moderate involvement. *Mediano* median, *Dedo* finger, *Palma* palm, *Muñeca* wrist, *Codo* elbow, *MIXTA* muñeca mixt wrist,  $\mu$ V microvolts, mA miliamps

neurological, and environmental factors. Trauma, injury, or a stressful event can trigger dystonia in some cases. Botulinum toxin (BT) is an effective treatment for dystonia and is administered intramuscularly [3, 4]. This drug produces neuromodulation that helps to reduce abnormal muscle contractions and alleviate associated pain, thereby improving muscle function [5, 6].

In contrast, CTS is a common neuropathy that affects the median nerve in the wrist [7]. This condition develops when the median nerve, which runs from the forearm to the hand through the carpal tunnel, is compressed or pinched at the wrist. Patients may experience numbness, tingling, weakness, and pain in the hand and fingers or radiating to the forearm, especially at night [8]. They may also have difficulty grasping small objects, weakness in the hand, or a burning sensation. Carpal tunnel syndrome is caused by compression of the median nerve in the carpal tunnel secondary to multiple factors such as pregnancy, rheumatoid arthritis, diabetes, obesity, joint cysts, or repetitive and forceful movements [9].

Despite appearing as distinct conditions, dystonia and CTS share overlapping clinical presentations, sometimes complicating their diagnosis and management.

## Case description

We present the case of a 39-year-old woman with no relevant medical history



**Fig. 2** ◀ Ultra-sound image of the infiltration of botulinum toxin in the flexor pollicis longus (FPL) muscle in the distal third of the forearm. Lateral access (L), over the radius (R) bone. The medial side (M) corresponds to the ulnar side

who was referred to the rehabilitation service with right-sided CTS. The patient was initially assessed by the traumatology service and diagnosed with moderate CTS through segmental electroneurography of the median nerve, showing signs of focal neuropathy at the carpal level with moderate involvement (■ Fig. 1; ■ Table 1), and was offered median nerve exoneurelysis in the carpal tunnel. However, the patient wished to explore less invasive alternatives and therefore requested evaluation by the rehabilitation service.

During the consultation, the patient reported pain from the distal ventral and radial third of the forearm, passing through the wrist to the first finger on the palm of the hand; difficulty with fine precision movements; fluctuating symptoms compatible with 3 years' evolution of right peripheral compression of the median nerve; cramps; and involuntary contraction of the pollex of the hand in her activities of daily living, including writing, crocheting, and using precision tweezers. The patient's medical history was unremarkable except for the CTS diagnosis. Physical examination of the hand at rest was unremarkable, but involuntary flexion of the first finger was noted while writing with the right hand, to the point of holding the pen with the dorsal region of the interphalangeal joint of the pollex, where calluses consistent with this pattern were evident.

Differential diagnosis was made considering first carpometacarpal joint osteoarthritis or tenosynovitis of the flexor pollicis longus (FPL), flexor carpi radialis muscle, isolated CTS, and focal dystonia

of the FPL muscle, with the latter being the most likely diagnosis.

As an initial treatment, infiltration of 15 units of onabotulinum toxin A (BT; diluted in 1 cc of saline solution per 100 units of BT) into the FPL muscle was proposed. The infiltration was performed with the patient seated facing the practitioner, with the forearm in supination and access from lateral to medial, avoiding the radial artery and the radius bone in the distal third of the forearm (■ Fig. 2). Needle visualization was performed in plane with a linear 12-5 (5–12 MHz) probe of the Philips® iU22 ultrasound.

At 5–6 days post-treatment, the patient experienced significant improvement in symptoms that had been present for a few weeks, prompting gradual increases in BT doses up to 25 units, with an initial infiltration interval of 4 months. Through successive infiltrations, she experienced an improvement in CTS symptoms that had been present for 18 months (the time during which she was periodically infiltrated with BT), resulting in a decrease in the frequency of pain occurrence from daily to sporadic.

During subsequent follow-up, we observed mirror hand dystonia, which involved 7involuntary and progressive flexion of the pollex while the patient was writing with her nondominant left hand (Video 1).

Despite significant improvement of mobility with the effect of BT treatment, the pattern of writing and manual activities of daily living constantly fluctuated, and the administration intervals progressively shortened. When the intervals became

**Table 1** Sensory neurophysiological study of the median nerve confirming signs of focal neuropathy at the carpal tunnel level with moderate involvement

| Nerve/location                       | Lat. | Amp.p. | Amp.p.p. | Dur.p.n. | Area p.n. | Dist. | Vel. |
|--------------------------------------|------|--------|----------|----------|-----------|-------|------|
|                                      | ms   | µV     | µV       | ms       | µVms      | mm    | m/s  |
| <i>R median—finger II-anti+mixta</i> |      |        |          |          |           |       |      |
| Palm                                 | 0.79 | 69.2   | 53.6     | 2.38     | 69.7      | 50    | 63.2 |
| Wrist                                | 3.50 | 32.9   | 54.7     | 2.75     | 48.4      | 90    | 33.2 |

*Lat* latency, *Amp* amperage, *Dur* duration, *Dist* distance, *Vel* speed

less than 3 months, they were inadequate to prevent the development of CTS symptoms, leading to the consideration of median nerve exoneurelysis in the carpal tunnel as a final option.

## Discussion

We encountered an atypical presentation of focal hand dystonia, which manifested unusually as CTS. This finding challenges the traditional perception of these two conditions as separate entities, suggesting their clinical association and thus complicating diagnosis.

Focal hand dystonia, also known as writer's cramp, presented as a silent intruder in this clinical case. This type of dystonia, classified as a movement disorder, manifests with involuntary and painful muscle contractions affecting the upper extremities. It is important to distinguish it from writer's block psychogenic origin and clear cognitive block [5]. Its prevalence reaches 9% according to Dressler, and its etiology can be diverse, including primary or idiopathic, hereditary, and sporadic causes, or it may arise a secondary consequence of various conditions such as metabolic disorders, neurodegenerative diseases, environmental factors, Parkinson disease, and pseudodystonia (such as those associated with syringomyelia, atlantoaxial subluxation, Klippel–Feil syndrome, Arnold–Chiari, and iatrogenesis), among others [1].

On the other hand, CTS is the most common compression mononeuropathy in our clinical practice, representing 20% of all compression syndromes and half of brachialgia cases. It mainly affects women around the age of 50 years, with the dominant side being more frequently involved. The incidence is 1–3 cases per 1000 inhabitants/year, with a prevalence of approximately 50 cases per 1000 people. In high-

risk groups, the incidence can increase up to 150 cases per 1000 inhabitants/year. Clinically, it presents with nocturnal paresthesia, a sensation of swelling in the fingers, and possible radiation of pain to the arm and shoulder, along with morning stiffness and decreased manual dexterity—typical symptoms that improve with manual therapy or position changes on a case-by-case basis.

The treatment of writer's cramp relieves pain through physiotherapy and manual therapy techniques, motor imagery, and BT, although the latter may result in transient weakness or paralysis. Our case was treated with BT due to moderate CTS involvement, and both outcomes manifested, including weakness (altering the writing pattern) and transient pain relief. For patients with mild or no CTS, our initial treatment would have consisted of conservative measures, such as neurodynamic techniques, precision pinch work, soft tissue massage, and targeted stretching of forearm and hand muscles [10, 11].

Electromyographic evaluation is recommended to confirm the diagnosis [11]. However, based on the experience gained in biomechanical exploration and daily treatment of patients with spastic patterns, attention was directed toward the FPL, as we observed flexion of the interphalangeal joint with progression of pollex flexion during writing (Video 1). Although adduction of the thumb is the first movement to occur, the most significant impairment is the forced flexion of the pollex, and that was the primary reason we selected the FPL for infiltration. The other muscles evaluated included the flexor pollicis brevis, abductor pollicis brevis, adductor pollicis brevis, and the opponens pollicis. In addition to the flexor pollicis longus affected in 28% of cases, other affected muscles may include the flexor digitorum superficialis (48%), flexor carpi ulnaris (42%), extensor

carpi ulnaris (34%), extensor carpi radialis (30%), and the flexor digitorum profundus (30%) [12]. These muscles are frequently implicated in upper limb spasticity [13].

The patient presented with characteristic symptoms of CTS, such as numbness, tingling, and pain in the hand and pollex, justifying the findings of the neurophysiology study (Fig. 1; Table 1). However, clinical findings of anomalous flexion during writing along with mirror dystonia (Video 1) prompted reconsideration of the diagnosis.

Mirror dystonia is a phenomenon characterized by the occurrence of dystonic movements in the unaffected hand during specific tasks. It has been observed in patients with focal hand dystonia. Evidence from studies suggests that impaired interhemispheric inhibition may play a contributory role in the development of mirror dystonia [14].

The favorable response to BT infiltration into the FPL confirmed focal dystonia as the true cause of the symptoms (Fig. 2). The other differential diagnoses considered were rhizarthrosis and tenosynovitis of the flexor carpi radialis, which were ruled out because of the patient's age and absence of characteristic mechanical pain.

Dystonia, by generating involuntary and spasmodic muscle contractions in the FPL, may have increased the pressure within the flexor retinaculum, thus compressing the median nerve and leading to the characteristic symptoms of CTS. This situation emphasizes the importance of a detailed medical history and maintaining a high index of suspicion.

Botulinum toxin has been successfully used for treating focal dystonia, and in this case, a significant improvement in symptoms was observed after the initial infiltration. However, despite the initial improvement, the patient experienced a recurrence that led to the decision to perform median nerve exoneurelysis in the carpal tunnel.

The evolution of this case highlights the complexity of managing patients with atypical manifestations of neuromuscular disorders such as focal dystonia. Although BT provided initial symptomatic relief, the need for surgical intervention for the underlying CTS underscores the importance of a multidisciplinary approach to managing these patients. Collaboration among

specialists is essential to ensure accurate diagnosis and optimal treatment in such complex cases. Furthermore, this case underscores the need for a broad differential diagnosis and ongoing surveillance to detect possible complications or disease progression in patients with atypical presentations of neuromuscular disorders.

Each clinical case is unique, and the treatment response may vary; therefore, we cannot be certain of how the patient would have responded to earlier diagnosis and treatment.

## Conclusion

This case has allowed us to delve into the complexity of focal hand dystonia, which in this instance presented atypically in rehabilitation consultations as CTS. This finding challenges the traditional perception of these entities as separate entities, revealing their close clinical association and the difficulties they pose for diagnosis and treatment. We emphasize the importance of a detailed medical history, a high index of suspicion, and a multidisciplinary approach to the management of patients with atypical presentations of neuromuscular disorders. Collaboration between different specialists is crucial to ensure accurate diagnosis and optimal treatment.

Botulinum toxin may be an effective therapeutic option; however, in cases of underlying CTS with established injury, surgical intervention may be unavoidable. Early diagnosis and appropriate treatment are essential for improving the management of these patients and for better understanding the impact of the timing of diagnosis and treatment on the evolution of different clinical presentations of pain.

## Corresponding address



### Francisco José Gallego-Peñalver

Departamento de Fisiatría y Enfermería,  
iHealthy Research Group, IIS Aragón,  
Universidad de Zaragoza  
C. Domingo Miral s/n, 50009 Zaragoza, Spain  
823591@posta.unizar.es  
franciscojosegp@gmail.com

**Funding.** Open Access funding provided thanks to the CRUE-CSIC agreement with Springer Nature.

## Declarations

**Conflict of interest.** F.J. Gallego-Peñalver and S.B. Romero-de-la-Higuera declare that they have no competing interests.

All procedures were conducted in compliance with the World Medical Association Code of Ethics. Informed consent and imaging consent were obtained, and the patient's privacy was protected. *Informed consent:* The patient provided informed consent for their case presentation and the use of images in accordance with the guidelines of the corresponding hospital. *Research compliance:* No studies involving human participants or animals were conducted by the authors for this article. All referenced studies adhered to ethical standards. For any identifiable patient information or images included in the manuscript, consent was obtained from the patient and/or their legal guardians.

**Open Access.** Dieser Artikel wird unter der Creative Commons Namensnennung 4.0 International Lizenz veröffentlicht, welche die Nutzung, Vervielfältigung, Bearbeitung, Verbreitung und Wiedergabe in jeglichem Medium und Format erlaubt, sofern Sie den/die ursprünglichen Autor(en) und die Quelle ordnungsgemäß nennen, einen Link zur Creative Commons Lizenz beifügen und angeben, ob Änderungen vorgenommen wurden. Die in diesem Artikel enthaltenen Bilder und sonstiges Drittmaterial unterliegen ebenfalls der genannten Creative Commons Lizenz, sofern sich aus der Abbildungslegende nichts anderes ergibt. Sofern das betreffende Material nicht unter der genannten Creative Commons Lizenz steht und die betreffende Handlung nicht nach gesetzlichen Vorschriften erlaubt ist, ist für die oben aufgeführten Weiterverwendungen des Materials die Einwilligung des jeweiligen Rechteinhabers einzuholen. Weitere Details zur Lizenz entnehmen Sie bitte der Lizenzinformation auf <http://creativecommons.org/licenses/by/4.0/deed.de>.

## References

- Ahmed SJ, Güss CD (2022) An analysis of writer's block: causes and solutions. *Creat Res J* 34(3):339–354. <https://doi.org/10.1080/10400419.2022.2031436>
- Chen R, Hallett M (1998) Focal dystonia and repetitive motion disorders. *Clin Orthop Relat Res* 9646753(351):102–106
- Jankovic J (2006) Treatment of dystonia. *Lancet Neurol* 5(10):864–872. [https://doi.org/10.1016/S1474-4422\(06\)70574-9](https://doi.org/10.1016/S1474-4422(06)70574-9)
- Klívényi P, Vécsei L (2001) A fokális dystoniák tünetnana, diagnosztikája és kezelése (Clinical symptoms, diagnosis and treatment of focal dystonias). *Orv Hetil* 142(42):2293–2297
- Lin PT, Shamim EA, Hallett M (2006) Focal hand dystonia. *Pract Neurol* 6:278–287
- Rodbard S (1970) Pain associated with muscle contraction. *Headache* 10(3):105–115. <https://doi.org/10.1111/j.1526-4610.1970.hed1003105.x>
- Szabo RM, Steinberg DR (1994) Nerve entrapment syndromes in the wrist. *J Am Acad Orthop Surg* 2(2):115–123. <https://doi.org/10.5435/00124635-199403000-00005>
- Cantatore FP, Dell'Accio F, Lapadula G (1997) Carpal tunnel syndrome: a review. *Clin Rheumatol* 16(6):596–603. <https://doi.org/10.1007/BF02247800>
- Simpson MA, Day B (2011) Painful numb hands. *Med J Aust* 195(7):388–391. <https://doi.org/10.5694/mja11.10900>
- Oskay D, Meriç A, Kirdi N, Firat T, Ayhan C, Leblebicioğlu G (2010) Neurodynamic mobilization in the conservative treatment of cubital tunnel syndrome: long-term follow-up of 7 cases. *J Manipulative Physiol Ther* 33(2):156–163. <https://doi.org/10.1016/j.jmpt.2009.12.001>
- Jiménez del Barrio S, Bueno Gracia E, Hidalgo García C, Estébanez de Miguel E, Tricás Moreno JM, Rodríguez Marco S et al (2018) Conservative treatment in patients with mild to moderate carpal tunnel syndrome: a systematic review. *Neurologia* 33(9):590–601. <https://doi.org/10.1016/j.nrleng.2016.05.015>
- Zakin E, Simpson DM (2021) Botulinum toxin therapy in writer's cramp and musician's Dystonia. *Toxins* 13(12):899. <https://doi.org/10.3390/toxins13120899>
- Filippetti M, Lugoboni L, Di Censo R, Degli Esposti L, Facciorusso S, Varalta V et al (2024) Classification of upper limb spasticity patterns in patients with multiple sclerosis: a pilot observational study. *J Rehabil Med* 56:jrm40548. <https://doi.org/10.2340/jrm.v56.40548>
- Beck S, Shamim EA, Richardson SP, Schubert M, Hallett M (2009) Inter-hemispheric inhibition is impaired in mirror dystonia. *Eur J Neurosci* 29(8):1634–1640. <https://doi.org/10.1111/j.1460-9568.2009.06710.x>

**Publisher's Note.** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.