

Cervical Dystonia as an Underrecognised Feature of Gaucher Disease Type 3: Successful Treatment With Botulinum Toxin in Two Paediatric Siblings

David Aktan ^{a,b}, Charlotte Mouraux ^{a,c}, Serpil Alkan ^{c,d}, Frédérique Depierreux ^{a,b}

^a GIGA – CRC – Rare Movement Disorders Research Group, University of Liege, Liege, Belgium

^b Department of Neurology, University Hospital of Liege, Liege, Belgium

^c Department of Human Genetics, University Hospital of Liege, Liege, Belgium

^d Department of Paediatrics, University Hospital of Liege, Liege, Belgium

david.Aktan@chuliege.be

Keywords

Gaucher disease; Cervical dystonia; Movement disorders; Botulinum toxin

Abstract

Cervical dystonia is an uncommon but significant manifestation of Gaucher disease type 3, where abnormal neck postures are often reported without detailed characterisation. We describe two brothers with genetically confirmed disease who developed severe retrocaput in early childhood, causing major gait, balance, and social difficulties. Both showed typical neurological signs, including supranuclear gaze palsy, parkinsonian features, and pyramidal involvement; one also had juvenile myoclonic epilepsy. Due to

severe dystonia, botulinum toxin injections were performed under ultrasound and electromyography guidance with light sedation. Both improved clearly and durably, underscoring the need to recognise treatable dystonia in this condition.

Introduction

Gaucher disease (GD) is the most common lysosomal storage disorder and results from biallelic pathogenic variants in *GBA1*, leading to deficient β -glucocerebrosidase activity and accumulation of glucosylceramide within lysosomes (1). The clinical spectrum is traditionally divided into three phenotypes based on neurological involvement: GD1, the non-neuronopathic form; GD2, the acute neuronopathic form with early and rapidly progressive neurological decline; and GD3, the chronic neuronopathic form with a heterogeneous course (2,3). In the latter form, horizontal supranuclear gaze palsy and oculomotor apraxia are the most characteristic neurological signs, although epilepsy, cognitive impairment, cerebellar ataxia, pyramidal signs, and parkinsonian features may also occur (1,2,4). A range of hyperkinetic movement disorders has also been reported in association with *GBA1* pathogenic variants, including dystonic tremor, hyperkinetic involuntary movements, blepharospasm, and even presentations evocative of rapid-onset dystonia-parkinsonism (4,5). Despite these observations, cervical dystonia remains insufficiently characterised in GD. Several reports refer to “abnormal cervical posture” or “retroflexion of the

neck”, particularly in GD3, but the dystonic nature of these postures is rarely documented (2,4). Only isolated descriptions of dystonia-like neck movements exist in GD3 (6). As a result, the true prevalence of cervical dystonia in GD3 is likely underestimated. Botulinum toxin type A (BoNT-A) is the first-line treatment for cervical dystonia in adults and is increasingly used in paediatric dystonia, although evidence remains limited and largely based on expert opinion (7,8). No published data exist regarding its use in GD, and the management of dystonia in this disease remains empirical. The multisystemic involvement of GD3, including respiratory vulnerability and skeletal deformities, raises additional concerns regarding procedural safety and optimal injection strategies (9). We report two brothers with genetically confirmed GD3 who developed severe cervical dystonia with prominent retrocaput in their early childhood and were treated successfully with BoNT-A injections performed under combined ultrasound (US) and electromyographic (EMG) guidance with paediatric sedation. To our knowledge, this is the first report documenting the efficacy and tolerability of BoNT-A for cervical dystonia in GD3.



FIGURE 1: Cervical dystonia in two brothers with Gaucher disease type 3: pre- (1,3) and post-treatment (2,4) images. Panels 1 and 2 show Patient A; panels 3 and 4 show Patient B. A marked improvement in head posture is observed one month after botulinum toxin injections. Note that no standardised dystonia rating scale (e.g. TWSTRS) was available for objective assessment, which represents a limitation of this report.

Case report

The two patients are brothers aged 5 and 4 years at the time of assessment. Patient A (eldest child) was

diagnosed with GD3 in infancy after targeted Sanger sequencing was performed because of early systemic symptoms, including hepatosplenomegaly. The same homozygous pathogenic *GBA1* variant (c.1448T>C,

p.Leu483Pro) was subsequently confirmed in patient B, his younger brother, who later developed similar systemic manifestations. Early developmental milestones in both children were marked by systemic involvement consistent with GD3 (splenomegaly, hepatomegaly and thrombocytopenia), and neurological features progressively emerged during early childhood, including horizontal supranuclear gaze palsy and oculomotor apraxia, parkinsonian features, pyramidal signs, and global language delay. The phenotype of patient B is more severe, with additional features including juvenile myoclonic epilepsy and stridor. Cervical dystonia appeared around the age of 2, during gait acquisition, and was initially described by caregivers as “a tendency for the head to fall backward”. This gradually evolved into a constant retrocaput associated with variable torticollis. The posture was not painful but severely interfered with balance, gait, and social interaction. During ambulation, the head was consistently pulled backward, forcing compensatory trunk flexion and limiting visual exploration. Clinical examination confirmed sustained involuntary activation of deep cervical extensors, consistent with a dystonic mechanism rather than pyramidal imbalance or orthopaedic restriction. This clinical impression was supported by electromyographic assessment, which demonstrated spontaneous and sustained activity in the cervical extensor muscles. Given the severity of the dystonia, BoNT-A treatment was proposed. Because of age, anxiety, and difficulty maintaining posture during the injections, both children underwent the procedure under light paediatric sedation. Nitrous oxide inhalation was used as the primary agent, occasionally supplemented with mild intravenous sedation when necessary. This approach ensured comfort, minimised movement, and allowed precise targeting of deep cervical muscles. All injections were performed using combined US and EMG guidance. US allowed visualisation of deep cervical muscles and vascular structures, while EMG confirmed dystonic overactivity and ensured accurate targeting of hyperactive muscle fibres. IncobotulinumtoxinA (Xeomin®) was used in all sessions. In patient A, the first session consisted of 50 units injected into both semispinalis capitis muscles, followed three months later by 80 units, extending the injection pattern to include the right sternocleidomastoid and splenius capitis muscles, taking into account a component of torticollis. In patient B, 50 units were administered during the first session into the bilateral semispinalis capitis and the left splenius capitis. One month after the first injection (Figure 1), patient B showed moderate improvement, maintaining a neutral head position while seated, although retrocaput persisted during gait examination. After the second injection, improvement became more marked, as he maintained a straight head and neck position approximately half of the time, including during ambulation. Patient A exhibited a more robust response. Two months after the first injection, he consistently maintained a neutral head position, with only a mild residual left torticollis during walking. Functional

gains included improved gait stability, enhanced social interaction, and increased autonomy during play activities. No adverse effects were observed in either child, and the therapeutic effect persisted for at least three months. The accompanying video (Video 1) illustrates the clinical presentation and treatment response, with pre-injection recordings and follow-up segments three months after the first botulinum toxin injection in both patients.

Discussion

The clinical signs observed, notably the abnormal posture of the head, are consistent with dystonia. According to the most recent consensus definition, dystonia is defined as a movement disorder characterised by sustained or intermittent muscle contractions causing abnormal, often repetitive movements or postures, which are typically patterned and may be task-specific or exacerbated by voluntary action (10,11). Unlike adult idiopathic cervical dystonia, paediatric cervical dystonia is frequently secondary to underlying neurogenetic disorders (12,13). In the present cases, the persistent and stereotyped retrocaput associated with involuntary activation of deep cervical extensor muscles, its progressive emergence during motor development, and its marked interference with gait and balance are fully consistent with this definition. The absence of pain, fixed orthopaedic limitation, or signs suggestive of predominant pyramidal imbalance further supports a dystonic rather than structural or compensatory mechanism. Together, these elements strengthen the clinical diagnosis of cervical dystonia and support its inclusion within the neurological phenotype of GD3 (10,11). These two cases illustrate that cervical dystonia may be an overlooked neurological manifestation of GD3, a condition more commonly characterised by oculomotor dysfunction, epilepsy, and pyramidal signs (1,2). Besides, dystonic features such as dystonic tremor, blepharospasm, and dystonia-parkinsonism presentations have been reported in all subtypes of *GBA1*-related disorders suggesting that dystonia may be more prevalent than currently appreciated (4,5). BoNT-A is well established as first-line therapy for cervical dystonia in adults and is increasingly used in children, with evidence supporting its efficacy and safety despite the low level of available data (7, 8). Our observations align with these findings, showing meaningful functional improvement without adverse effects. The deep cervical muscles involved in retrocaput require precise targeting, and inaccurate injections may expose the patient to the risk of dysphagia or neck weakness, particularly in children with multisystemic disease. The use of combined US and EMG guidance enhances accuracy and reduces complications, an approach particularly valuable in rare diseases where anatomical variations or compensatory postures may complicate injection planning (7–9). Pain and anxiety during intramuscular injections are major concerns in children. Nitrous oxide is a well-established option for

procedural sedation, offering rapid onset, good tolerability, and minimal respiratory depression (14). In our cases, sedation facilitated optimal positioning and allowed safe access to deep cervical muscles. Given the potential respiratory vulnerability in GD, careful anaesthetic planning is essential, and a multidisciplinary approach is recommended (9,15). These observations suggest that cervical dystonia in GD3 may be more prevalent than currently recognised and that targeted chemodenervation using BoNT-A can provide significant functional benefits. Early identification and treatment may help reduce functional impairment and potentially limit secondary complications directly related to dystonia. Although this report describes only two cases, both patients have now received repeated BoNT-A injections every three months, corresponding to the period of efficacy. Besides, for more than five years of follow-up, we observed a sustained efficacy of the treatment and good tolerability. Larger studies or multicentre registries would help establish standardised protocols.

Conclusion

Cervical dystonia is a possible but overlooked neurological manifestation of GD3, and possibly of other paediatric neurogenetic disorders. In these two paediatric siblings, BoNT-A injections performed under combined US and EMG guidance, with appropriate paediatric sedation, resulted in significant and sustained improvement in head posture, gait, and quality

of life. The treatment was well tolerated, with no adverse effects. These observations suggest that, as in many types of focal dystonia, botulinum toxin is a valuable therapeutic option and should be considered in cases of GD3 with dystonic features, while highlighting the importance of recognising dystonia as part of the neurological phenotype. Further studies are needed to better characterise dystonia in GD and to develop evidence-based treatment guidelines.

Statements

Informed consent: the patients' father has given his written consent for the use of the patients' photographs and videos for the purpose of this scientific work.

Conflict of interest statement: The authors declare no conflicts of interest.

Funding: No external funding was received for this work.

Supplementary Video 1 –

Cervical dystonia in Gaucher disease type 3.

The video material supporting the findings of this study can be available on demand (main author).

- Segment 1-1: Patient A before botulinum toxin injection, showing severe retrocaput during gait.
- Segment 1-2: Patient A three months after the first injection, with significant improvement in head posture.
- Segment 2-1: Patient B before injection, showing sustained cervical extension during ambulation.
- Segment 2-2: Patient B two months after injection, with improvement of the retrocaput component and residual mild torticollis.

https://www.youtube.com/watch?v=x00RiSM_Q_c

REFERENCES

1. Stirnemann J, Belmatoug N, Camou F, Serratrice C, Froissart R, Caillaud C, et al. A Review of Gaucher Disease Pathophysiology, Clinical Presentation and Treatments. *Int J Mol Sci.* 2017 Feb 17;18(2):441. doi:10.3390/ijms18020441 PubMed PMID: 28218669; PubMed Central PMCID: PMC5343975.
2. Bulut FD, Kor D, Kılavuz S, Şeker Yılmaz B, Kaplan İ, Ekinçi F, et al. Expanding the phenotypic landscape of Gaucher disease type 3c with a novel entity - Transient neonatal cholestasis. *Eur J Med Genet.* 2023 Jun;66(6):104764. doi:10.1016/j.ejmg.2023.104764
3. Gary SE, Ryan E, Steward AM, Sidransky E. Recent advances in the diagnosis and management of Gaucher disease. *Expert Rev Endocrinol Metab.* 2018 Mar 4;13(2):107–18. doi:10.1080/17446651.2018.1445524
4. Machaczka M, Paucar M, Björkvall CK, Smith NJC, Cox TM, Forsgren L, et al. Novel hyperkinetic dystonia-like manifestation and neurological disease course of Swedish Gaucher patients. *Blood Cells Mol Dis.* 2018 Feb;68:86–92. doi:10.1016/j.bcmd.2016.10.011
5. Hertz E, Lopez G, Lichtenberg J, Haubenberger D, Tayebi N, Hallett M, et al. Rapid-Onset Dystonia and Parkinsonism in a Patient With Gaucher Disease. *J Mov Disord.* 2023 Sep;16(3):321–4. doi:10.14802/jmd.23074 PubMed PMID: 37309111; PubMed Central PMCID: PMC10548083.
6. Gumus E, Karhan AN, Hizarcioglu-Gulsen H, Demir H, Ozen H, Saltik Temizel IN, et al. Clinical-genetic characteristics and treatment outcomes of Turkish children with Gaucher disease type 1 and type 3: A sixteen year single-center experience. *Eur J Med Genet.* 2021 Nov;64(11):104339. doi:10.1016/j.ejmg.2021.104339
7. Vova JA, Green MM, Brandenburg JE, Davidson L, Paulson A, Deshpande S, et al. A consensus statement on the use of botulinum toxin in pediatric patients. *PM&R.* 2022;14(9):1116–42. doi:10.1002/pmrj.12713
8. Rasera A, Squintani GM, Cerruto MA. A Systematic Review of Botulinum Toxin Injection in Pediatric Dystonia. *Toxins.* 2024 Jun 26;16(7):289. doi:10.3390/toxins16070289 PubMed PMID: 39057929; PubMed Central PMCID: PMC11281719.
9. Salaün JP, Scholtes JL, Veyckemans F. Planning anesthesia of a child with a rare disease: useful tools. *Anaesth Crit Care Pain Med.* 2023 Dec;42(6):101284. doi:10.1016/j.accpm.2023.101284
10. Albanese A, Bhatia KP, Fung VSC, Hallett M, Jankovic J, Klein C, et al. Definition and Classification of Dystonia. *Mov Disord.* 2025;40(7):1248–59. doi:10.1002/mds.30220
11. Albanese A, Bhatia K, Bressman SB, DeLong MR, Fahn S, Fung VSC, et al. Phenomenology and classification of dystonia: A consensus update. *Mov Disord.* 2013 Jun;28(7):863–73. doi:10.1002/mds.25475
12. Singer HS, Gilbert DL, Mink JW, Jankovic J. *Movement Disorders in Childhood.* Elsevier; 2016. doi:10.1016/C2012-0-07271-7
13. Brandsma R, van Egmond ME, Tijssen MAJ, Groningen Movement Disorder Expertise Centre. Diagnostic approach to paediatric movement disorders: a clinical practice guide. *Dev Med Child Neurol.* 2021 Mar;63(3):252–8. doi:10.1111/dmcn.14721
14. Nugud A, Alhoos S, Agabna M, Babiker MOE, El Bashir H. Analgesia and sedation modalities used with botulinum toxin injections in children with cerebral palsy: a literature review. *Sudan J Paediatr.* 2021;21(1):6–12. doi:10.24911/SJP.106-1604549033 PubMed PMID: 33879937; PubMed Central PMCID: PMC8026001.
15. Hardy PY, Hallett C, Kirsch M, Samalea Suarez N, Hick G, Petry J, et al. Anesthetic Management of a Child With Rapid-Onset Dystonia-Parkinsonism (DYT12-ATP1A3): A Case Report. *AA Pract.* 2021 Apr;15(4):e01440. doi:10.1213/XAA.0000000000001440

mustela®



Soins pour le change : une solution pour chaque situation

**Crème
change
1 2 3**

Dès les premières
rougeurs



Liniment





93^e réunion du GBPF
4^e congrès francophone de la BAoP
21 novembre 2026 • ECOLYS • Namur

Au rythme des urgences: du calme à la tempête.

9h → 13h **Matinée**

9h **Plantons le décor**

- 112: Pompiers, ambulances, quelle est votre urgence ?
- Périple aux urgences pédiatriques à travers les yeux d'un enfant.
- Zéro stress, zéro douleur.
- FLASH: La médecine d'urgence dans la poche.

11h10 **Top 5 des urgences**

- Douleurs thoraciques et malaises: ces plaintes qui nous embêtent.
- Les boutons d'urgence ?!
- Gare à la bosse !
- Trop petit, trop chaud.
- FLASH: La médecine d'urgence dans la poche (gauche!).

13h **Pause lunch – visite des stands**

14h → 18h **Après-midi**

14h • «*Pediavox: les actualités pédiatriques belges*».

14h20 **Vague à l'âme**

- Quand le vase déborde.
- Place aux accompagnants..
- La communication thérapeutique, ça se soigne

16h20 **Quand la clinique
ne suffit pas**

- To scan or not to scan ?
- Hocus POCUS.
- Examens complémentaires: alliés ou ennemis ?

18h • Fin de la réunion scientifique.

Renseignements :

- Secrétariat scientifique:
Dr F. Mascart
francoise.mascart@chc.be
- Secrétariat administratif:
Dr F. Kanen
kanen.francois@hotmail.be
- Papaver Scientific Communication -
b.giroul@papaver-communication.be

Inscriptions et
détails de la
journée sur
www.baop.be

Avec le soutien de

