

Short Communication

Neuromyelitis optica spectrum disorder mimicking stroke: A case report and literature review

Bo Hu^{a,1}, Ge Dang^{a,1}, Siyan Chen^a, Shanshan Li^b, Yi Guo^a, Zhuoxing Li^{a,*}^a Department of Neurology, Shenzhen People's Hospital (The Second Clinical Medical College, Jinan University, The First Affiliated Hospital, Southern University of Science and Technology), Shenzhen, Guangdong, China^b Department of Radiology, Shenzhen People's Hospital (The Second Clinical Medical College, Jinan University, The First Affiliated Hospital, Southern University of Science and Technology), Shenzhen, Guangdong, China

ARTICLE INFO

Keywords:

Neuromyelitis optica spectrum disorder
Stroke
Hemiparesis

ABSTRACT

Hemiparesis is a frequently observed manifestation of stroke but exceptionally rare in the context of neuromyelitis optica spectrum disorder (NMOSD). In this case, a 68-year-old woman initially presented with acute right-sided weakness, leading to suspicion of ischemic stroke. However, her symptoms worsened despite treatment with aspirin and statins. Subsequent spinal MRI and aquaporin 4 antibody testing confirmed the diagnosis of NMOSD. The administration of methylprednisolone and immunoglobulin resulted in improved clinical outcomes. This case serves as an illustrative example of the diverse manifestations encountered in NMOSD and underscores the significance of considering this potential etiology in elderly patients to facilitate prompt diagnosis and therapeutic intervention.

1. Introduction

Neuromyelitis optica spectrum disorder (NMOSD) is a severe autoimmune disease of the central nervous system characterized by the presence of serum anti-aquaporin-4 (AQP4-IgG) antibodies that mostly affects the optic nerve and spinal cord (Wingerchuk et al., 2007). Presence of longitudinal extensive transverse myelitis (LETM) that extends over three or more segments and involves all or most of the cross-sectional area of the spinal cord on magnetic resonance imaging (MRI) is another feature of NMOSD (Goh et al., 2014). The clinical manifestation of LETM include motor, sensory, and autonomic disturbances (Transverse Myelitis Consortium Working G, 2002). Early diagnosis and treatment using corticosteroids and immunoglobulins, or plasmapheresis, are crucial for the prevention of severe neurological disability in patients with NMOSD (Fragoso et al., 2019). Hemiparesis is most commonly caused by stroke, such as cerebral infarction, and rarely by spinal cord lesions (Matsumoto et al., 2012). Misdiagnosis of spinal cord disorders as ischemic stroke, and treatment using alteplase, antiplatelet therapy, or anticoagulation may delay or even worsen spinal cord disease. NMOSD mimicking stroke with the initial presentation of hemiparesis is quite infrequent; however, timely differential diagnosis and management play a pivotal role in achieving favorable clinical

outcomes. Herein, we report a case of a patient with NMOSD who presented with sudden-onset hemiparesis that was initially misdiagnosed as acute cerebral infarction.

2. Case report

A 68-year-old woman presented with a sudden onset of right-sided weakness, inability to lift the right arm, and difficulty walking, leading to her admission to a local hospital. The initial diagnosis at the local hospital indicated an acute ischemic stroke, and she was treated with aspirin and statins. However, her symptoms worsened, progressively leading to complete loss of ambulation, alongside with symptoms of dizziness, headache, and urinary retention. Subsequently, she was transferred to our hospital 1 week after the initial onset. Her medical history indicated that she had hypertension for 4 years but did not take medications regularly. Upon admission, the neurological examination revealed motor weakness (Medical Research Council strength score 2/5) in the right arm and leg. Diminished pinprick and temperature sensations were observed in the right lower extremity. Bilateral positive Babinski reflexes were present, and assessment of deep tendon reflexes revealed hyperreflexia in all extremities. Other aspects of the neurological examination exhibited no abnormalities. On the 8th day

* Corresponding author at: Department of Neurology, Shenzhen People's Hospital, 1017 Dongmen North Road, Shenzhen 518000, Guangdong, China.
E-mail address: leeqq@126.com (Z. Li).

¹ Co first author.

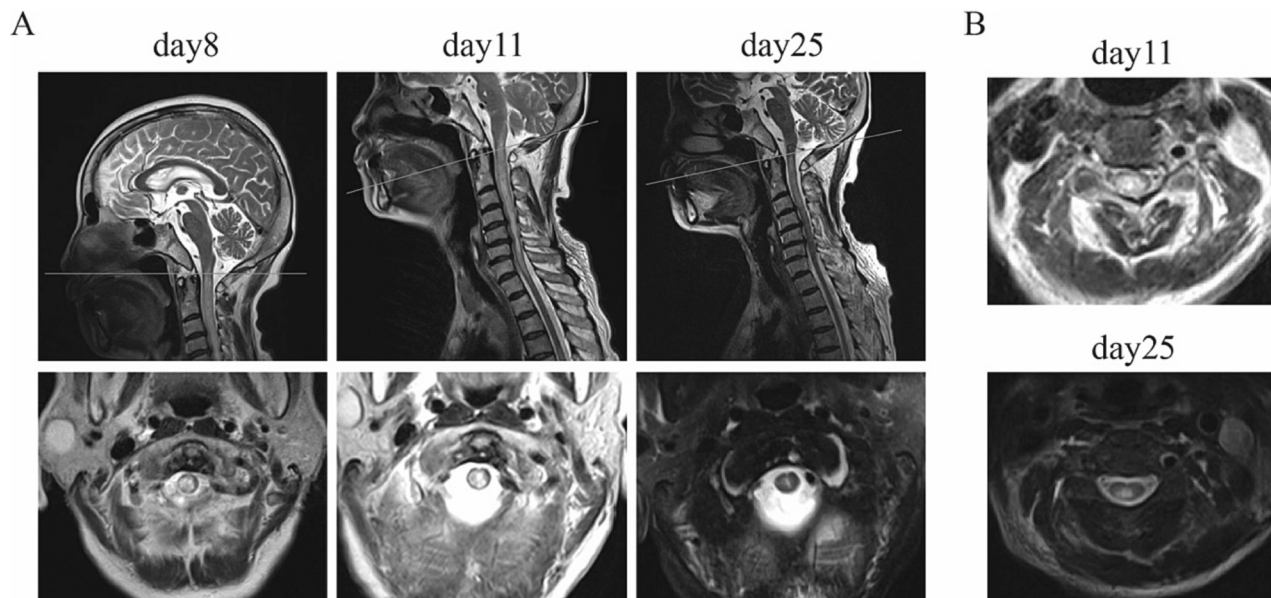


Fig. 1. Serial magnetic resonance imaging show the evolution of a longitudinal extensive transverse myelitis in the patient. A. Sagittal and axial MR images at C2 level. B. Axial MR images at C4 level. (The axial images at day 25 are fat suppressed T2-weighted images, and the others are T2-weighted.)

following symptom onset, the patient underwent brain magnetic resonance imaging (MRI), which did not demonstrate any acute ischemic changes in the brain. However, a T2 hyperintensity was noticed in the cervical cord, predominantly affecting the right portion with the lateral regions of the left portion being relatively spared, as observed in the cross-sectional view (Fig. 1). A spinal MRI conducted on day 11 demonstrated a longitudinally extending T2 hyperintensity from the medulla oblongata to the first thoracic vertebrae, with transverse involvement across the majority of the spinal cord area (Fig. 1). Cerebrospinal fluid (CSF) analysis showed a glucose level of 4.34 mmol/L, protein concentration of 0.757 g/L, and a white cell count of 100/ μ L with lymphocyte predominance (97%). No isolated CSF oligoclonal bands were observed. The patient exhibited an elevated serum AQP4 IgG antibody level of 10.94 U/mL (normal range: < 3 U/mL). Additionally, the patient showed elevated levels of serum antithyroglobulin antibody (TGAb) (>4000 U/mL), serum thyroid peroxidase antibody (TPOAb) (>1000 U/mL), and thyroid-stimulating hormone receptor antibody (>40 IU/L). Thyroid-stimulating hormone levels were high (143.88 mIU/L, normal range: 0.38–5.91 mIU/L), while levels of T3 (0.66 nmol/L, normal range: 1.01–2.48 nmol/L), T4 (47.22 nmol/L, normal range: 69.97–152.52 nmol/L), FT3 (2.92 pmol/L, normal range: 3.28–6.47 pmol/L), and FT4 (3.28 pmol/L, normal range: 7.64–16.03 pmol/L) were low. The patient received a confirmed diagnosis of NMOSD. Intravenous methylprednisolone (500 mg/day) and immunoglobulin (10 g/day) over a duration of five days were administered since day 8. A gradual reduction in the methylprednisolone dosage was implemented subsequently. As treatment progressed, the patient gradually demonstrated improvement, manifested by an increase in muscle strength to 3/5 by day 25. Concurrently, symptoms such as dizziness and headache gradually resolved, and urinary retention showed improvement. The follow-up spinal MRI showed a decreased longitudinally extending T2 hyperintensity involving the C1 to C6 vertebrae, with predominant transverse involvement in the right segment of the spinal cord area. These are suggestive of a favorable treatment response. Ultimately, the patient was discharged.

3. Discussion

The case raised initial suspicion of acute stroke primarily due to the sudden onset of hemiparesis, as opposed to the characteristic bilateral

symptoms commonly observed in LETM associated with NMOSD. Nevertheless, NMOSD was confirmed by heightened levels of AQP4-IgG antibodies in her serum and CSF, as well as the spinal MRI manifestation. Two documented cases of stroke-like NMOSD in patients aged over 80 have been reported thus far. Li et al. reported an 81-year-old male with sudden-onset left-sided weakness and numbness, diagnosed with NMOSD based on spinal MRI findings of longitudinally extensive T2 hyperintensities (C3 to C7) and the presence of AQP4 antibodies in serum (Li et al., 2022). Similarly, Suchdev et al. described an 84-year-old female with sudden-onset right-sided numbness and weakness, showing longitudinally extensive T2 hyperintensity (C3 to T1) on spine MRI and elevated levels of AQP4 IgG antibodies in both serum and CSF (Suchdev et al., 2017).

The Transverse Myelitis Consortium Working Group's diagnostic criteria for "transverse myelitis" necessitate a clinically appropriate presentation of bilateral symptoms related to the spinal cord (Transverse Myelitis Consortium Working G, 2002). However, it is challenging to use because inflammatory myelopathies may not always align with the "classic" definition of the syndrome, with possible occurrences of unilateral and asymmetric presentations (Barreras et al., 2018). In NMOSD, spinal cord MRI reveals lesions typically encompassing over 50% of the cross-sectional area, situated either centrally or in a combined central and peripheral pattern (Dutra et al., 2018). The area along the central canal of the spinal cord is preferentially involved and corresponds to the most prominent expression of AQP4 in ependymocytes (Rash et al., 1998). Pathologically, the distinct MRI lesions may stem from necrotic and microcystic changes associated with substantial intrinsic cord demyelination, focal edema, or CSF trapping (Dutra et al., 2018). Transverse myelitis present with asymmetric symptoms may associate with the asymmetric pathological involvement of the spinal cord. In this case, the unilateral weakness lasts from the onset accompanying the asymmetric manifestations on transverse MRI.

NMOSD is always associated with other autoimmune diseases, including autoimmune thyroid diseases. Anti-thyroid antibodies, such as TGAb and TPOAb, are commonly detected in AQP4-positive NMOSD (Shahmohammadi et al., 2019). AQP4 is expressed in the follicular epithelial cells in normal thyroid tissues (Niu et al., 2012) and that AQP4 IgG may be hazardous to the thyroid for this reason. TPOAb may also be associated with the severity of LETM. Li et al. observed that LETM involving more vertebral segments is more common in patients with

TPOAb(+) NMOSD than in those with TPOAb(−) NMOSD (Li et al., 2015). Both the present case and the case reported by Suchdev et al. (Suchdev et al., 2017) demonstrated elevated levels of TGAb and TPOAb antibodies, along with the presence of LETM involving more than six segments. It is suggested that the autoimmune thyroid diseases may be indicative of the coexistence of other autoimmune diseases, such as NMOSD.

In conclusion, although hemiparesis due to NMOSD is rare, physicians should be aware of this possible etiology in elderly patients with stroke-like symptoms. Spinal MRI and the AQP4 antibody test are strongly recommended if patients suspected of having stroke show negative brain MRI findings. Positive results in tests for anti-thyroid antibodies and other autoimmune antibodies may be another indication. Early diagnosis and treatment are crucial for reducing the risks of morbidity and mortality in patients with NMOSD.

Funding source

This work is supported by the National Natural Science Foundation of China (NSFC 81901208) and the Medical Science and Technology Research Foundation of Guangdong Province (grant number A2019174).

Declaration of Competing Interest

None.

Data availability

Data will be made available on request.

References

- Barreras, P., Fitzgerald, K.C., Mealy, M.A., Jimenez, J.A., Becker, D., Newsome, S.D., et al., 2018. Clinical biomarkers differentiate myelitis from vascular and other causes of myelopathy. *Neurology*. 90, e12–e21.
- Dutra, B.G., da Rocha, A.J., Nunes, R.H., Maia, A.C.M.J., 2018. Neuromyelitis optica spectrum disorders: Spectrum of mr imaging findings and their differential diagnosis. *Radiographics*. 38, 169–193.
- Fragoso, Y.D., Ruocco, H.H., Dias, R.M., Cabeça, H., Gonçalves, R., de Carvalho Sousa, N. A., et al., 2019. Late onset of neuromyelitis optica spectrum disorders. *Neurol. Ther.* 8, 477–482.
- Goh, C., Desmond, P.M., Phal, P.M., 2014. Mri in transverse myelitis. *J. Magn. Reson. Imaging* 40, 1267–1279.
- Li, H., Dai, Y., Wu, A.M., Sun, X., Lin, Y., Lv, K., et al., 2015. Anti-thyroid antibodies and cerebrospinal fluid findings in neuromyelitis optica spectrum disorders. *J. Neuroimmunol.* 281, 38–43.
- Li, L., Fang, G.L., Zheng, Y., Zhang, Y.X., 2022. Late-onset neuromyelitis optica spectrum disorder mimicking stroke in an elderly chinese man: case report. *J. Spinal Cord Med.* 45, 148–150.
- Matsumoto, H., Miki, T., Miyaji, Y., Minami, H., Masuda, A., Tominaga, S., et al., 2012. Spontaneous spinal epidural hematoma with hemiparesis mimicking acute cerebral infarction: two case reports. *J. Spinal Cord Med.* 35, 262–266.
- Niu, D., Kondo, T., Nakazawa, T., Kawasaki, T., Yamane, T., Mochizuki, K., et al., 2012. Differential expression of aquaporins and its diagnostic utility in thyroid cancer. *PLoS One* 7, e40770.
- Rash, J.E., Yasumura, T., Hudson, C.S., Agre, P., Nielsen, S., 1998. Direct immunogold labeling of aquaporin-4 in square arrays of astrocyte and ependymocyte plasma membranes in rat brain and spinal cord. *Proc. Natl. Acad. Sci. U. S. A.* 95, 11981–11986.
- Shahmohammadi, S., Doosti, R., Shahmohammadi, A., Mohammadianinejad, S.E., Sahraian, M.A., Azimi, A.R., et al., 2019. Autoimmune diseases associated with neuromyelitis optica spectrum disorders: a literature review. *Mult. Scler. Relat. Disord.* 27, 350–363.
- Suchdev, K., Razmjou, S., Venkatachalam, P., Khan, O.A., Mohamed, W., Ibrahim, M.S., 2017. Late onset neuromyelitis optica mimicking an acute stroke in an elderly patient. *J. Neuroimmunol.* 309, 1–3.
- Transverse Myelitis Consortium Working G, 2002. Proposed diagnostic criteria and nosology of acute transverse myelitis. *Neurology*. 59, 499–505.
- Wingerchuk, D.M., Lennon, V.A., Lucchinetti, C.F., Pittock, S.J., Weinshenker, B.G., 2007. The spectrum of neuromyelitis optica. *Lancet Neurol.* 6, 805–815.