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A Rare Case of Longitudinally Extensive Transverse Myelitis Following Pfizer-BioNTech COVID-19 Vaccination with a Favourable Outcome

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ABSTRACT

Introduction: mRNA COVID-19 vaccines are very safe, but rare adverse events such as transverse myelitis have been reported after COVID-19 vaccination.

Case Description: We report the case of 50-year-old man who presented with progressive lower extremity weakness, back pain and urinary retention after his second dose of the Pfizer COVID-19 vaccine. MRI of the spine revealed longitudinally extensive transverse myelitis (LETM). He recovered completely after treatment with intravenous methylprednisone and physical therapy.

Discussion: This case highlights the rare association between LETM and COVID-19 vaccines and encourages clinicians to maintain a high index of suspicion for prompt diagnosis and treatment.

LEARNING POINTS

- Longitudinally extensive transverse myelitis (LETM) is rare adverse events after mRNA COVID-19 vaccination.
- Clinicians should maintain a high index of suspicion for prompt diagnosis of vaccine-induced transverse myelitis.
- Vaccine-induced LETM should show marked clinical improvement after appropriate treatment.

KEYWORDS

COVID-19, transverse myelitis, mRNA COVID-19 vaccines, autoimmune disease

INTRODUCTION

Longitudinally extensive transverse myelitis (LETM) is a rare subtype of transverse myelitis (TM) which extends over three or more vertebral segments and presents with spinal cord dysfunction, including rapid onset weakness, sensory loss, and bowel and bladder dysfunction [1]. Central nervous system (CNS) demyelination disorder, systemic inflammatory disorders, infectious and paraneoplastic syndromes and vaccination are known causes of TM [2, 3]. Headache, dizziness, muscle pain and spasm, myalgia and paraesthesia are common neurological symptoms; however, rare cases of stroke, Guillain-Barre syndrome, facial palsy, seizures, acute disseminated encephalomyelitis and TM have been reported after COVID-19 vaccination [4]. We report the case of a 50-year-old man admitted to hospital 20 days after his second dose of the Pfizer COVID-19 vaccine with progressive lower extremity weakness and numbness, back pain and urinary retention. Investigation and imaging results were consistent with LETM.

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CASE DESCRIPTION

A 50-year-old man with no significant past medical history presented to the emergency department with progressive weakness and numbness of the bilateral lower extremities, back pain, and difficult urination for 2 days. He denied fever, chills, headache, dizziness, vision changes, chest pain, shortness of breath, abdominal pain, nausea and vomiting. He had no history of recent trauma, travel or contact with a sick person. He reported COVID-19 infection 10 months earlier with complete recovery without treatment. He had received his second dose of the Pfizer COVID-19 vaccine 20 days previously.

His initial vital signs were blood pressure of 136/72 mmHg, temperature of 36.7°C, heart rate of 76 beats/min, and respiratory rate of 16 breaths/min with 98% saturation on room air. The physical examination revealed decreased strength in the bilateral lower extremities (muscle power 4/5), decreased vibration sense and proprioception in the bilateral lower extremities with sensory level at T4, and brisk reflexes (3+) in all four extremities with a positive Babinski reflex and ataxic gait. The rest of the physical examination was unremarkable. The laboratory studies, including complete blood count and comprehensive metabolic panel, were unremarkable. A COVID-19 PCR test was negative. MRI of the brain was unremarkable. However, MRI of the spine (cervical/thoracic/lumbar) revealed multiple relatively long segments of increased cord signal diffusely throughout the cervical and thoracic cord with lesions mainly affecting C2–C5 (*Fig. 1*) and T2–T7 (*Fig. 2*).

Cerebrospinal fluid (CSF) studies revealed pleocytosis and elevated protein with normal glucose, as shown in *Table 1*.

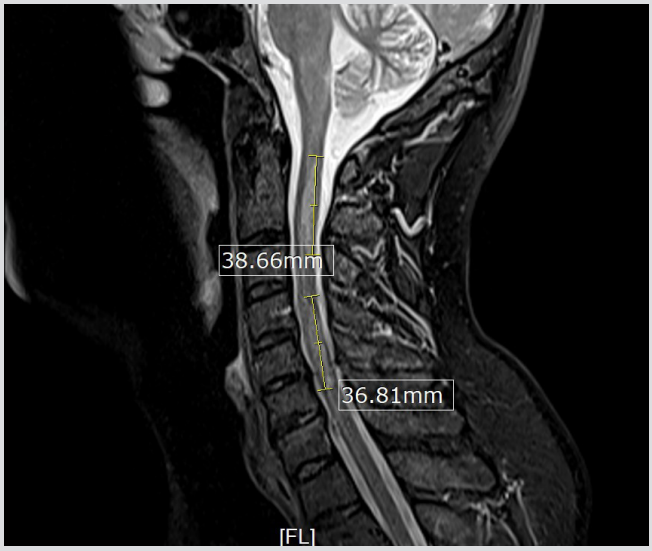

Figure 1. MRI of the cervical spine showing long segments of increased cord signal with C2–C5 involvement

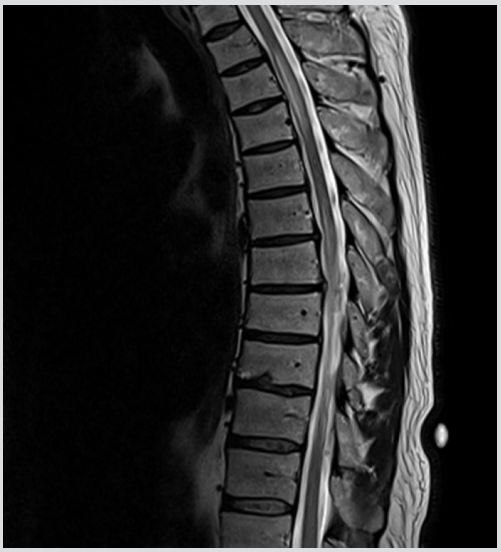

Figure 2. MRI of the thoracic spine showing long segments of increased cord signal with T2–T7 involvement

Variable	Reference range	Reported values
Nucleated cells	0–10/µl	129/µl
Neutrophils	0–6%	17%
Lymphocytes	40–80%	12%
Monocytes	15–45%	71%
Glucose	55–88 mg/dl	59 mg/dl
Protein	15–45 mg/dl	68 mg/dl
Oligoclonal bands	0–1 bands	0 bands

Table 1. Cerebrospinal fluid study results during hospitalization

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Additional work-up including CSF oligoclonal band, angiotensin-converting enzyme, aquaporin 4 receptor antibody (NMO-IgG), antimyelin oligodendrocyte glycoprotein (MOG) antibody, Lyme antibodies, meningitis panel, West Nile virus IgG and IgM, HIV, syphilis rapid plasma reagin, serum vitamin B12, serum copper, antinuclear antibody, antibody to an extractable nuclear antigen, rheumatoid factor and a paraneoplastic CSF panel, was unremarkable. The diagnosis of LETM secondary to COVID-19 vaccination was made by a diagnosis of exclusion.

The patient was started on intravenous methylprednisone 1000 mg daily for 5 days. After five doses of methylprednisolone and physical therapy, his lower extremity weakness had improved (muscle power 5/5). He reported improved sensation in both feet, although numbness and tingling persisted. He was started on oral prednisone 1 mg/kg/day for 2 weeks, followed by a gradual taper, and discharged to the acute rehabilitation unit (ARU) to continue physical therapy. After 1 week of extensive physical therapy at ARU, he was discharged home. He continued outpatient physical therapy three times a week and completed recovery in about 1 month.

DISCUSSION

Acute TM is a rare, acquired neuro-immune spinal cord disorder with an incidence of 1.34–4.6 cases per million annually [5], and vaccine-associated myelitis is even more rare [6]. CNS demyelinating disorders (multiple sclerosis, neuromyelitis optica spectrum disorder (NMOSD), MOG antibody disorder, acute disseminated encephalomyelitis (ADEM)), systemic inflammatory disorders (systemic lupus erythematosus (SLE), sarcoidosis, Sjogren's syndrome), infectious (enterovirus, HIV, syphilis) and paraneoplastic syndromes and vaccines (hepatitis B, measles, mumps, rubella, diphtheria, tetanus, pertussis) have been associated with TM [2, 3, 6]. TM has been reported as a complication of both COVID-19 infection and COVID-19 vaccination [7]. The pathogenesis of vaccine-associated myelitis is unclear. It is proposed that infectious agents and vaccine adjuvants may induce immune reactions by various proposed mechanisms such as molecular mimicry, epitope spreading, upregulation of cytokines, and polyclonal activation of B and T lymphocytes leading to TM [8]. However, mRNA COVID vaccines do not use adjuvants, and TM is less common with mRNA COVID vaccines than with viral vector COVID vaccines such as Johnson and Johnson and AstraZeneca [7]. mRNA COVID vaccines encode the pre-fusion SARS-CoV-2 spike protein; autoimmune reactions between SARS-CoV-2 spike protein antibody and tissue proteins or ACE2 receptors have been the proposed mechanism of mRNA COVID vaccine-induced TM [9]. COVID-19 vaccination has played a significant role in curbing the COVID-19 pandemic. mRNA COVID vaccines are very safe. However, with mass immunization against COVID-19, various adverse events have been reported, including severe neurological adverse effects such as TM [4]. A literature review revealed 12 cases of TM after mRNA COVID-19 vaccination, which are summarized in *Table 2*.

However, TM is a rare adverse event and marked clinical improvement can occur with prompt diagnosis and appropriate treatment, as shown in our case. Intravenous methylprednisone followed by oral prednisone is the most common therapeutic approach in reported cases of vaccination-induced TM. However, a few cases have been treated with subsequent plasma exchange and IV immunoglobulins along with methylprednisone therapy (*Table 2*). Further studies will be needed to determine the exact pathogenesis, risk factors, and treatment for mRNA COVID-19 post-vaccination TM.

CONCLUSION

This case highlights the rare association between LETM and mRNA COVID-19 vaccination and encourages clinicians to maintain a high index of suspicion for vaccine-induced TM for prompt diagnosis and treatment.

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Author	Country	Age/ Gender	Vaccine and doses	Clinical presentation	Symptom onset	MRI Finding	Management	Outcome
Gao et al.[10]	Taiwan	76/F	Moderna mRNA-1273 1st dose	Unsteadiness and abnormal sensation in the lower limbs	6 Days	Cervical cord C2–C5 on T2 images	Intravenous methylprednisone (IVMP) for 5 days followed by oral	Marked improvement
Alabak et al.[11]	Canada	26/F	Pfizer1st dose	Progressive saddle numbness and allodynia	3 Days	T2 short segment and diffusely enhancing lesion at T5	IVMP for 5 days, pregabalin	Minimal improvement of symptoms
Hirose et al. [12]	Japan	70/M	Moderna 1st dose	Progressive sensorimotor dysfunction in bilateral lower limbs	7 Days	Intramedullary lesion T1–T2, T5–T6	IVMP for 5 days followed by oral prednisone, gradual taper	Complete improvement
Fernandes et al.[13]	West Indies	26/F	Pfizer1st dose	Progressive lower limb weakness and left upper limb weakness	2 Days	Medulla to T1 level	IVMP for 5 days followed by oral taper prednisolone, rituximab	Complete improvement
Miyaue et al.[14]	Japan	75/M	Pfizer1st dose	Sensory loss below the umbilicus and complete paralysis in both legs	3 Days	Longitudinally hyperintense lesion from the lower thoracic to lumbar spine	Steroids and plasma exchange	Limited recovery
Khan et al. [15]	USA	67/F	Moderna 1st dose	Tingling sensation in right lower extremity and difficulty walking	5 Days	MRI cervical spine, hyperintense lesion C1–C3,	IVMP for 3 days, no improvement, followed by plasmapheresis for 5 days	Marked improvement
Fitzsimmons et al.[16]	USA	63/M	Moderna 2n dose	Severe pain in lower back, legs, feet, unable to walk, urinary difficulty	2 Days	MRI spine, T2 cord signal distal spinal cord and conus	IV immunoglobulin for 2 days, followed by IVMP for 5 days, prednisone taper	Marked improvement
McLean et al.[17]	USA	69/F	Pfizer 1st dose	Bilateral upper and lower extremity weakness	2 Days	MRI spine, non-compressive myelitis C3–C4, T2–T3	IVMP for 5 days	Residual weakness with gradual improvement
Nakano et al.[18]	Japan	85/M	Pfizer 2nd dose	Progressive gait disturbance and urinary retention	15 Days	MRI spine, longitudinally hyperintense lesion T3–T5	IVMP for 3 days followed by oral prednisone	No improvement, developed pneumonia and later died in hospital
Eom et al.[19]	Korea	81/M	Pfizer 2nd dose	Bilateral hand weakness and numbness	3 Days	MRI spine, high signal intensity C1–C3	IVMP for 5 days, oral prednisone taper for 2 weeks	Marked improvement
		23/F	Pfizer 1st dose	Tingling sensation in both thighs and leg weakness	3 Weeks	MRI spine, high signal intensity on conus medullaris	IVMP for 5 days, followed by oral prednisone taper for 2 months	Marked improvement
Albokhari et al.[20]	Saudi Arabia	16/F	Pfizer2nd dose	Lower extremity weakness and difficulty walking	2 Days	C2–C3 plaques with mild cord expansion at T10	IVMP for 5 days	Complete recovery

Table 2. Cases of transverse myelitis after mRNA-based COVID-19 vaccination

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REFERENCES

1. Kitley JL, Leite MI, George JS, Palace JA. The differential diagnosis of longitudinally extensive transverse myelitis. *Mult Scler J* 2012;**18**(3):271–285.
2. Trebst C, Raab P, Voss EV, Rommer P, Abu-Mugheisib M, Zettl UK, et al. Longitudinal extensive transverse myelitis—it's not all neuromyelitis optica. *Nat Rev Neurol* 2011;**7**:688–698.
3. Baxter R, Lewis E, Goddard K, Fireman B, Bakshi N, DeStefano F, et al. Acute demyelinating events following vaccines: a case-centered analysis. *Clin Infect Dis* 2016;**63**:1456–1462.
4. Goss AL, Samudralwar RD, Das RR, Nath A. ANA investigates: neurological complications of COVID-19 vaccines. *Ann Neurol* 2021;**89**(5):856–857.
5. Bhat A, Naguwa S, Cheema G, Gershwin ME. The epidemiology of transverse myelitis. *Autoimmun Rev* 2010;**9**(5):A395–A399.
6. Agmon-Levin N, Kivity S, Szyper-Kravitz M, Shoenfeld Y. Transverse myelitis and vaccines: a multi-analysis. *Lupus* 2009;**18**(13):1198–1204.
7. Hsiao YT, Tsai MJ, Chen YH, Hsu CF. Acute transverse myelitis after COVID-19 vaccination. *Medicina* 2021;**57**(10):1010.
8. Zanoni G, Nguyen TM, Destefani E, Masala L, Nardelli E, Tridente G. Transverse myelitis after vaccination. *Eur J Neurol* 2002;**9**:696–697.
9. Vojdani A, Kharrazian D. Potential antigenic cross-reactivity between SARS-CoV-2 and human tissue with a possible link to an increase in autoimmune diseases. *Clin Immunol* 2020;**217**:108480.
10. Gao JJ, Tseng HP, Lin CL, Shiu JS, Lee MH, Liu CH. Acute transverse myelitis following COVID-19 vaccination. *Vaccines (Basel).* 2021;**9**(9):1008.
11. Alabkal J, Rebchuk AD, Lyndon D, Randhawa N. Incomplete subacute transverse myelitis following vaccination with Pfizer-BioNTech COVID-19 mRNA vaccine: a case report. *Cureus* 2021;**13**(12):e20460.
12. Hirose S, Hara M, Koda K, Natori N, Yokota Y, Ninomiya S,et al. Acute autoimmune transverse myelitis following COVID-19 vaccination: a case report. *Medicine (Baltimore)* 2021;**100**(51):e28423.
13. Fernandes J, Jaggernauth S, Ramnarine V, Mohammed SR, Khan C, Panday A. Neurological conditions following COVID-19 vaccinations: chance or association? *Cureus* 2022;**14**(2): e21919.
14. Miyaue N, Yoshida A, Yamanishi Y, Tada S, Ando R, Hosokawa Y, Yabe H, Nagai M. A case of refractory longitudinally extensive transverse myelitis after severe acute respiratory syndrome oronavirus 2 vaccination in a japanese man. *Intern Med* 2022;**61**(5):739-742.
15. Khan E, Shrestha AK, Colantonio MA et al. Acute transverse myelitis following SARS-CoV-2 vaccination: a case report and review of literature. *J Neurol* 2022;**269**,1121–1132.
16. Fitzsimmons W, Nance CS. Sudden onset of myelitis after COVID-19 vaccination: an under-recognized severe rare adverse event. Available at SSRN 3841558. 2021 May 5. doi.org/10.2139/ssrn.3841558
17. McLean P, Trefts L. Transverse myelitis 48 hours after the administration of an mRNA COVID 19 vaccine. *Neuroimmunology Reports* 2021;**1**:100019.
18. Nakano H, Yamaguchi K, Kawabata K, Asakawa M, Matsumoto Y. Acute transverse myelitis after BNT162b2 vaccination against COVID-19: Report of a fatal case and review of the literature. *J Neurol Sci* 2022;**434**:120102.
19. Eom H, Kim SW, Kim M, Kim YE, Kim JH, Shin HY, Lee HL. Case reports of acute transverse myelitis associated with mRNA vaccine for COVID-19. *J Korean Med Sci.* 2022;**37**(7):e52.
20. Albokhari AA, Alsawas A, Adnan MH, Alasmari A, Aljuhani S, Almejalli M, Kedah H. Acute inflammatory transverse myelitis post-Pfizer-BioNTech-COVID-19 vaccine in 16-year-old. JMRI 2021;**5**:1-4. doi: 10.25259/JMRI_25_2021