

COVID-19 Associated Transverse Myelitis: A Rare Neurologic Complication

Keith Brown^{1*}, Matthew Everwine¹, James Brady¹ and David Roshal²¹*Division of Internal Medicine, Rowan University School of Medicine at Jefferson Health New Jersey, Stratford, New Jersey, United States*²*Division of Neurology, Jefferson New Jersey Neurology, Voorhees, New Jersey, United States****Corresponding Author:** Keith Brown, Division of Internal Medicine, Rowan University School of Medicine at Jefferson Health New Jersey, Stratford, New Jersey, United States.**Received:** January 19, 2021**Published:** February 16, 2021© All rights are reserved by **Keith Brown, et al.****Abstract**

The SARS-CoV-2 virus typically affects the respiratory tract inducing cough and shortness of breath with associated viral prodromal symptoms. However, the virus's predilection for the respiratory tract is not exclusive. There have been reports of different neurologic implications from COVID-19 infections. One such sequela, albeit rare, includes acute transverse myelitis. Transverse myelitis is an acute inflammatory condition of the spinal cord manifesting with myelopathy. Given its uncommon occurrence, the literature involving acute transverse myelitis secondary to COVID-19 is limited to case reports. The case that follows describes a 31 year old female complaining of acute back pain with lower extremity weakness in the setting of transverse myelitis from COVID-19. Diagnosis was made via MRI with contrast which demonstrated focal enhancement of the spinal cord at T3-T4. The patient underwent further evaluation including lumbar puncture, all of which was unrevealing. She was subsequently diagnosed with acute transverse myelitis from COVID-19 and placed on intravenous steroids with interval symptomatic improvement. Given evolving evidence of the SARS-CoV-2 virus's involvement in organ systems other than the respiratory tract, it is imperative to keep a broad differential for neurological complaints when dealing with a known COVID-19 positive patient.

Keywords: COVID-19; Transverse Myelitis; Coronavirus; Neurologic Complication; Myelopathy**Abbreviation**

COVID-19: Coronavirus Disease; TM: Transverse Myelitis; IVIG: Intravenous Human Immunoglobulin.

Introduction

The novel coronavirus disease (COVID-19) outbreak emerged in December 2019 and is a worldwide pandemic which has caused innumerable deaths and has affected millions of lives since it was first discovered. Sequence analysis has revealed that SARS-CoV-2 is an enveloped, positive-sense single stranded RNA virus that is

zoonotic in origin [1,2]. Various neurologic manifestations of COVID-19 have been described throughout the literature to include Guillain-Barré, focal encephalitis, cerebrovascular accidents, and acute transverse myelitis [6]. The complications and long term effects of COVID-19 remain to be defined given the novelty of the disease. We report a case of acute transverse myelitis associated with COVID-19 infection in an otherwise healthy 31-year-old female.

Case Report

The patient is a 31 year old African-American female who presented to the emergency department with a new onset of back pain

and worsening bilateral lower extremity weakness that started 3 weeks prior to her arrival. She also complained of intermittent numbness and tingling of bilateral lower extremities. The patient was able to ambulate unassisted, but was unable to walk long distances as her legs felt heavy and weak. She denied any trauma to the area of pain and did not report any saddle anesthesia, however she did report infrequent urinary incontinence. Preceding the onset of these neurologic symptoms the patient had been recently diagnosed with a urinary tract infection with symptoms of urgency and frequency and was treated with trimethoprim-sulfamethoxazole. She was also evaluated by an Orthopedic Spine Specialist and an MRI was ordered, but she was unable to report to her scheduled testing secondary to her persistent back pain. Her past medical history includes depression for which she takes venlafaxine 75mg daily and alprazolam 0.5mg twice a day. She reports compliance with her medication regimen. Her social history was negative for tobacco, alcohol, or illicit drug use. Her family history was positive for maternal hypertension, but negative for any neurologic disorders.

Upon arrival to the emergency department her vital signs were significant for mild tachycardia at 101 beats per minute. On physical examination she was awake, alert, and oriented to person, place, and time. Auscultation of her chest revealed clear breath sounds bilaterally, with normal heart sounds. Her abdomen was soft and non-distended and her lower extremities were non-edematous. There were no signs of joint erythema, edema or tenderness. Neurologic examination revealed intact cranial nerves as well as intact motor and sensory examinations in the upper extremities. Bilateral lower extremities muscle strength was $\frac{4}{5}$ with mild decreased sensation of her bilateral lower extremities specifically over the lateral thighs with hypersensitivity of her medial thighs. Reflexes were 2+ in her upper extremities and 1+ in her lower extremities. Her gait was observed as slowed but unassisted during this examination.

Her initial lab work was unremarkable with the exception of mild hypoglycemia of 63mg/dL, CRP was mildly elevated at 0.60mg/dL with a normal ESR. An MRI of the cervical, thoracic, and lumbar spine revealed a short segment enhancing cord abnormality which was located at the T3-T4 level involving most of the spinal cord. There was minimal disc bulging at the levels of L3-L4, L4-L5,

L5-S1 without significant spinal canal stenosis or neural foraminal narrowing. No evidence of spinal cord infarction was observed (Figure 1-3). She was tested for COVID-19 given neurologic manifestations of COVID-19 which was positive. She was admitted to the hospital for workup and management of her symptoms under the Department of Internal Medicine with Neurology consultation.

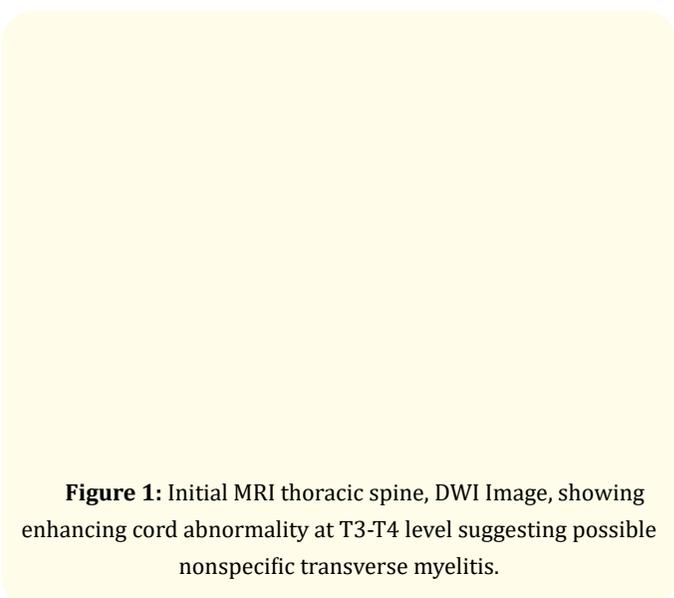


Figure 1: Initial MRI thoracic spine, DWI Image, showing enhancing cord abnormality at T3-T4 level suggesting possible nonspecific transverse myelitis.

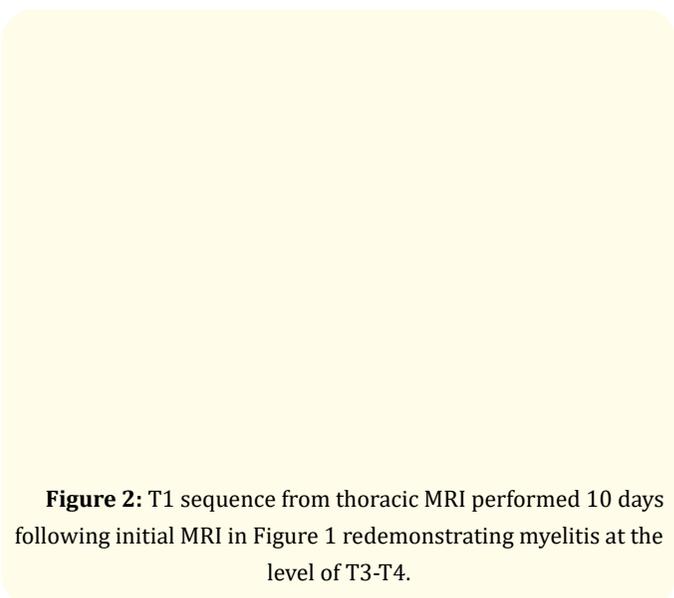


Figure 2: T1 sequence from thoracic MRI performed 10 days following initial MRI in Figure 1 redemonstrating myelitis at the level of T3-T4.

Figure 3: T2 sequence from thoracic MRI performed 10 days following initial MRI in Figure 1 redemonstrating myelitis at the level of T3-T4.

A diagnostic lumbar puncture was performed during her hospitalization which revealed a WBC of 8, glucose of 94mg/dL, and a protein of 19mg/dL. Cytology was negative for malignancy, but did reveal scattered lymphocytes. A meningitis and encephalitis panel along with aerobic and anaerobic culture and gram stains were sent which were negative for any organisms. HIV, Hepatitis A core IgM, Hepatitis B core IgM, Hepatitis B surface antibody, Hepatitis C antibody, C3-C4 complement were all negative. A rheumatologic, autoimmune, and paraneoplastic workup were also performed to include anti-smith antibody, ANCA, angiotensin converting enzyme (ACE), dsDNA, RNP antibody, anti-NR1, anti-GAD65, anti-LGI1, anti-VGKC, anti-CASPR2, anti-amphiphysin, anti-CV2, anti-Hu, anti-Ma, and anti-Ta were all negative.

Given the patient's symptomatology in the setting of COVID-19 positive testing, the patient was diagnosed with post infectious COVID-19 associated transverse myelitis. The patient was treated with 1000 mg of intravenous methylprednisolone daily for 3 days which did mildly improve her numbness and tingling, but her

symptoms did persist. She worked vigorously with Physical Therapy services and it was recommended that she be discharged home with a rolling walker. She was scheduled for outpatient follow up with Neurology in 4 weeks with a repeat MRI of the thoracic spine.

The patient returned to the hospital 6 days after her discharge date with complaints of worsening lower extremity numbness and tingling. The patient was again admitted to the Department of Internal Medicine with Neurology consultation and was again treated with 1000mg of intravenous methylprednisolone x 3 days which significantly improved her symptoms. She was discharged home on a prednisone steroid taper and to follow up with Neurology in 4 weeks with a repeat MRI of the thoracic spine.

Discussion

The classic manifestations of COVID-19 have been reported to affect the respiratory tract to include fever, cough, and shortness of breath [1]. COVID-19 has now been associated with many neurologic manifestations such as headache, dizziness, and anosmia which often precludes complications such as cerebrovascular accident, acute encephalitis, Guillain Barre syndrome, and transverse myelitis. Transverse myelitis (TM) is a rare non-compressive myelopathy characterized by onset of inflammation of the spinal cord causing neurologic dysfunction [2]. Transverse myelitis can be the initial sign of neurologic conditions such as multiple sclerosis, systemic autoimmune diseases, or associated with viral or bacterial infections. Multiple sclerosis was extensively considered in our patient given her demographics of age and ethnicity which are typical of those with increased prevalence of multiple sclerosis. However, given the onset of her clinical symptoms of bilateral symmetric sensory changes with extremity weakness and bladder incontinence along with typical findings of contrast-enhancing lesions on MRI, she was diagnosed with transverse myelitis in the setting of COVID-19 [5].

The incidence of COVID-19 infection associated with transverse myelitis is unknown, but has been infrequently reported in the literature [1-7]. However, the recognized number of patients with neurologic manifestations of COVID-19 continue to increase, but given the uncertainty of adequate diagnosis and management of

this novel virus, MRI of the spine is often not obtained, but MRI is the image modality of choice for patients with symptoms of acute myelitis [1,4]. A proposed mechanism for neurologic disease in the setting of COVID-19 is attributed to the presence of ACE2 receptors expressed on the membrane of the spinal cord neurons [6]. SARS-CoV2 strongly binds to ACE2 receptors in skeletal muscle, heart, lungs, and CNS and triggers an inflammatory cascade which may explain the observed symptoms of this virus [3]. Oftentimes, a lumbar puncture is performed to rule out other etiologies. Infectious as well as autoimmune and paraneoplastic etiologies were ruled out in our patient after the concerning findings of transverse myelitis on MRI.

Treatment of COVID-19 related neurologic conditions have yet to be standardized. However, multiple case reports of COVID-19 associated transverse myelitis have shown improvement with treatment of daily intravenous methylprednisolone or dexamethasone, while others did not [2-7]. The duration of steroid use is also an area for further investigation. Our patient’s symptoms did initially improve with only 3 days of intravenous steroids, however her symptoms did recur and she was again treated with a 3 day course of steroids and discharge on an oral steroid taper. The use of intravenous human immunoglobulin (IVIG) and plasmapheresis are also an area for further investigation as it has been used in previously reported cases of COVID-19 associated transverse myelitis with variable success [5,7]. Not until additional risk factors are identified and clinical trials validate treatment will we have a standardized regimen for treatment of this condition.

Conclusion

COVID-19 has now been associated with many neurological complications which include transverse myelitis. Young patients without underlying pre-existing conditions can also develop serious complications as a result of the virus. This report highlights the case of a previously healthy young female who contracted COVID-19 and developed transverse myelitis. The therapeutic treatment regimen is yet to be formally established, but multiple case reports to date have treated patients with COVID-19 associated transverse myelitis with high dose IV steroids for 3-5 days. This case also raises the consideration for a steroid taper on discharge

for complete amelioration of symptoms. A broad differential is extremely important as we continue to see the wide range of effects of COVID-19 and take care of patients who have contracted this unpredictable virus.

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Conflict of Interest

The authors have no conflict of interest to disclose.

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