



Introduction

- On December 31, 2019 the World Health Organization (WHO) was informed of many pneumonia cases of unknown etiology that occurred in Wuhan, China¹. The outbreak was later confirmed to be caused by a novel coronavirus that has since rapidly spread worldwide. The WHO formally declared a pandemic of COVID-19 on March 11, 2020.
- As patients rapidly decline with acute respiratory distress syndrome (ARDS) requiring ventilation support, the patients end up in the intensive care unit. This can lead to critical illness polyneuromyopathy involving motor and sensory nerves².
- Prone positioning has been shown to reduce mortality in ARDS and has been widely used for such patients affected by the COVID-19 viral pneumonia³.
- Prone positioning can be associated with various complications, including upper limb nerve injuries related to brachial plexus neuropathy⁴.

Case Description

A 53 year-old male with history of diabetes with HgA1C 10.5 and recent 50-day hospitalization due to COVID-19 infection is admitted to acute inpatient rehabilitation for critical illness myopathy due to COVID-19 viral pneumonia. The patient was intubated for 27 days with a prone positioning protocol and noted right upper extremity weakness and paresthesia after extubation. He noted some improvement in the distal muscles of his right hand over time, but continues to experience difficulty with shoulder abduction, elbow flexion, and elbow extension. During his acute inpatient rehabilitation stay, he was referred to the EMG clinic for evaluation of a possible brachial plexus injury.

Objective Findings

Physical examination:

Manual muscle testing:

Muscle Group	Right	Left
Shoulder Abduction	0	5
Elbow Flexion	0	5
Wrist Extension	0	5
Elbow Extension	0	4
Finger Flexion	4	5
Finger Abduction	2	5
Grip strength	4	5

Muscle stretch reflexes:

- Absent at the right biceps and triceps; 2+ at the left biceps with absent left triceps
- Patellar reflexes are 1+ bilaterally; Achilles reflexes are absent bilaterally

Sensation to light touch:

- Diminished in the right axillary patch and lateral forearm
- Sensation to light touch appears normal in both hands

Electrodiagnostic Study

Findings:

Sensory Nerve Conduction Studies:

- The **right lateral antebrachial cutaneous nerve** response was **absent** in the setting of a normal left lateral antebrachial cutaneous nerve response.
- The **right radial nerve** response at the **thumb** was **absent** in the setting of a normal left radial response.
- The **right median nerve** response at the **thumb** was **slowed** with normal amplitude and symmetric with the left response.
- The **bilateral median nerve** responses at the **index finger** were **absent**.
- The **right median nerve** response at the **long fingers** was **slowed with decreased amplitude** in the setting of an absent left median response at the long finger.
- The **right median nerve** response at the **ring finger** was **slowed** with normal amplitude in the setting of an absent left-sided response at the ring finger.
- The **right medial antebrachial cutaneous nerve** response was **absent** in the setting of a normal left medial antebrachial cutaneous response.

Motor Nerve Conduction Studies:

- The **median nerve** responses at the **bilateral thenar eminences** show **slowed distal onset latency with decreased amplitude and slowed conduction velocity**.
- The **ulnar nerve** responses at the **bilateral hypothenar eminences** were within the established reference range with respect to onset latency, with **slightly decreased amplitude and slightly decreased conduction velocity distally**.
- The **right radial nerve** response at the **EIP** was **absent**; the left radial response at the EIP was present with decreased amplitude.
- F-wave studies** of the **right median and ulnar nerves** were **slowed**.

Needle EMG:

Muscle	Nerve	Roots	Spontaneous activity	Amp	Dur	Recruitment
R Deltoid	Axillary	C5-C6	IA: increased Fib: 1+ PSW: 1+	none	none	none
R Biceps brachii	Musculocutaneous	C5-C6	IA: increased Fib: 2+ PSW: 2+	none	none	none
R Brachioradialis	Radial	C5-C6	IA: increased Fib: 2+ PSW: 2+	low	low	discrete, small amp
R Triceps brachii	Radial	C6-C8	IA: increased Fib: 2+ PSW: 2+	none	none	none
R Pronator teres	Median	C6-C7	normal	normal	normal	normal
R Extensor digitorum communis	Radial	C7-C8	IA: increased Fib: 2+ PSW: 2+	normal	normal	none
R First dorsal interosseous	Ulnar	C8-T1	IA: increased Fib: none PSW: none	increased	normal	normal
R Cervical paraspinals	Spinal	C4-C8	normal			

- Needle EMG examination of the muscles in the C5-T1 myotomes of the bilateral upper extremities using a disposable monopolar needle electrode revealed **abnormal spontaneous activity in the right deltoid, biceps, brachioradialis, triceps, extensor digitorum communis, and first dorsal interosseous**. Motor unit action potential analysis revealed discrete low, amplitude motor units in the brachioradialis.

Interpretation:

This is an abnormal electrodiagnostic exam of the right upper extremity.

- Today's study shows electrodiagnostic evidence of an **axonal upper trunk brachial plexopathy** also affecting the **posterior and lateral cord**. No motor units were seen in the right deltoid, biceps and triceps so prognosis is guarded
- There is also electrodiagnostic evidence for **bilateral median neuropathies at the wrists**, consistent with carpal tunnel syndrome.
- There is also electrodiagnostic evidence for a chronic **peripheral neuropathy** as evidenced by motor units of increased amplitude in the **first dorsal interosseous** muscle.

Recommendation:

A repeat electrodiagnostic study in 3-6 months is recommended to further assess recovery.

Electrodiagnostic studies of the bilateral lower extremities may be beneficial to assess bilateral foot drop.

Outcome

The patient completed 24 days of acute inpatient rehabilitation prior to being safely discharged home. Despite the right upper extremity pan-brachial plexopathy, the patient made significant improvements on all ADLs, transfers, and mobility.

Self-Care	Admission (GG Score)	Discharge (GG Score)
Eating	Partial/Mod assist (3)	Setup/Clean up assist (5)
Oral Hygiene	Setup/Clean up assist (5)	Independent (6)
Toileting Hygiene	Dependent (1)	Partial/Mod assist (3)
Toilet transfer	Not attempt due to safety	Supervision/touch assist (4)
Shower/bathe self	Max assist (2)	Partial/Mod assist (3)
Upper body dressing	Dependent (1)	Partial/Mod assist (3)
Lower body dressing	Dependent (1)	Partial/Mod assist (3)
Put on/taking off footwear	Max assist (2)	Supervision/touch assist (4)
Car Transfer	Not attempted due to safety	Supervision/touch assist (4)
Walk 10ft	Not attempt due to safety	Supervision/touch assist (4)
Walk 150ft	Not attempted due to safety	Supervision/touch assist (4)
12 Steps (up/down w/wo rail)	Not attempted due to safety	Partial/Mod assist (3)
Wheelchair Use	Yes	No

Conclusions

The novel COVID-19 has brought on many medical challenges. One major complication is the development of pneumonia with acute respiratory distress syndrome (ARDS) requiring intubation. Prone positioning is used to improve ventilation for the management of ARDS. Injury to the brachial plexus may result from prone positioning due to the compression and stretching of the brachial plexus when shoulders are posteriorly displaced in abduction and external rotation. Brachial plexus injuries should be considered in patients undergoing prone positioning. In our patient, a course of acute inpatient rehabilitation significantly improved the functional outcomes for mobility, transfers, and ADLs in the setting of a right upper extremity pan-brachial plexopathy likely secondary to prone positioning.

References

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