Case Report

Parsonage-Turner syndrome following COVID-19 vaccination and review of the literature

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ABSTRACT

Background: Parsonage-Turner syndrome (PTS) is a rare brachial plexopathy characterized by self-limiting shoulder girdle and upper arm pain followed by the upper extremity weakness and sensory changes. While the etiology is not well-understood, the most common cause of PTS is thought to be postviral. There are at least nine reports, to the best of our knowledge, of PTS associated with COVID-19 infection and nine reports associated with COVID-19 vaccination.

Case Description: Here, we present a case of PTS after COVID-19 vaccination in a 64-year-old male and a review of the current literature.

Conclusion: PTS can occur post-COVID-19 vaccination and should be on the differential diagnosis when patient continues to experience shoulder pain and develops weakness or sensory changes in the extremity.

Keywords: COVID-19, Idiopathic brachial neuritis, Parsonage-Turner syndrome, SARS-CoV-2, Vaccine

INTRODUCTION

Parsonage-Turner syndrome (PTS) is a rare upper extremity disorder with an incidence of 1.64/100,000 people. Furthermore, it is known as idiopathic acute brachial neuritis or neuralgic amyotrophy, the syndrome typically involves the upper and middle brachial plexus trunks.¹⁵,⁴³ It is predominantly unilateral and manifests with initial shoulder girdle pain and progression to the upper extremity patchy sensory changes and proximal weakness.¹⁵,⁴³ The syndrome is usually self-limiting, resolving over weeks to months, with full resolution by 3 years.¹⁵,⁴³ The pathophysiology and etiology of PTS are not well-understood. Several published etiologies include hereditary, infection, vaccination, surgery, trauma, or autoimmune.¹,⁴,⁶,¹⁶,¹⁸,²²,³²,³⁵,³⁶,³⁹-⁴¹,⁴⁶ The most common etiology is postviral infection. To date, there are only nine published case reports of PTS associated with the novel SARS-CoV-2 (COVID-19) infection and nine case reports associated with COVID-19 vaccination.²,³,⁷-¹²,¹⁷,₂¹,₂₄,₂₆,₂₈,₃₀,₃₃,₃₇,₄₄,₄₅

CASE DESCRIPTION

A 64-year-old previously healthy right-handed senior neurosurgeon with a medical history of hypertension and hyperlipidemia received his first dose of COVID-19 vaccine (mRNA-1273; ModernaTX, Inc.; Cambridge, Massachusetts) without any clinically significant side effects other
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than transient malaise and fatigue. After his scheduled second COVID-19 vaccine dose administered again into the left deltoid, he experienced mild shoulder soreness and transient rigors in the first 12–24 h. However, 2 weeks postvaccination, he developed intense, unremitting left shoulder girdle pain with associated muscle tenderness that was not relieved with conservative measures such as stretching, heat, or anti-inflammatories (ibuprofen 800 mg Q.I.D.). A week thereafter, he noticed decreased strength and dexterity in the left hand with difficulty opening bottle caps and manipulating small instruments. Within the next few days, he also noted sensory loss with paresthesia and hypoesthesia in the left fourth and fifth digits, as well as on the ulnar aspect of the forearm. His neurologic examination was notable for decreased strength in the left finger extensors (4+/5), particularly in the left fourth and fifth digits, and thenar eminence (4+/5). Reflexes were normal. Sensation was impaired to light touch distally in the left fourth and fifth digits and to a lesser extent in the third digit. Brachial plexitis was suspected and he was started on a steroid taper treatment with prednisone (80 mg/day for 3 days followed by a rapid taper of 20 mg decrease per day to off).

Three weeks after his initial symptom onset, he underwent an electromyogram (EMG) and nerve conduction study (NCS). The right median and right radial sensory nerve action potentials (SNAPs) (unaffected side) had low amplitude, but these were felt to be incidental and related to known prior trauma to that hand. The left median SNAPs were normal, including the lateral and medial antebrachial cutaneous sensory nerves. The left median abductor pollicis brevis compound motor action potentials (CMAPs) were normal as well. The left ulnar SNAP and left ulnar-abductor digiti minimi CMAPs had borderline low amplitude. The left median and ulnar F waves were unremarkable. Needle EMG demonstrated a reduced recruitment pattern in the left extensor indices and left flexor digitorum profundus to digit IV, with increased spontaneous activity in the left first dorsal interosseous. These findings were felt to reflect a mild, patchy, and acute-to-subacute lower trunk brachial plexopathy [Table 1]. Magnetic resonance imaging (MRI) of the left brachial plexus revealed increased short-T1 inversion recovery (STIR) signal and increased T2-weighted signal, with mild T1 postcontrast enhancement of the medial left scalene muscles along the inferior brachial plexus consistent with inflammatory changes and intramuscular edema [Figure 1].

Over the course of the next month, there was gradual improvement in finger sensation and strength with near complete resolution by 4 months.

**DISCUSSION**

PTS is a rare brachial plexopathy famously described by Parsonage and Turner in 1948, but was first reported by Dreschfeld in 1886.[13,31] It commonly affects males more than females and has been reported in ages ranging from 3 months to 75 years, with peak incidence between the third and seventh decades.[23,27,28,41] PTS commonly presents with acute, diffuse shoulder girdle, and upper arm pain followed by proximal upper extremity weakness, commonly in the muscles innervated by the upper plexus (supraspinatus,

| Table 1: EMG/NCS results. |
|----------------------------|
| **Nerve conduction studies** |
| Left median digit II        | Normal SNAP |
| Right median digit II       | Reduced SNAP amplitude compared to contralateral side (thought to be incidental from known prior trauma). |
| Left ulnar digit V          | Normal SNAP |
| Right ulnar digit V         | Normal SNAP |
| Left radial snuffbox        | Normal SNAP |
| Right radial snuffbox       | Reduced SNAP amplitude compared to contralateral side (thought to be incidental from known prior trauma). |
| Left lateral antebrachial cutaneous | Normal SNAP |
| Right lateral antebrachial cutaneous | Normal SNAP |
| Left median antebrachial cutaneous | Normal SNAP |
| Right medial antebrachial cutaneous | Normal SNAP |
| Left median abductor pollicis brevis | Normal CMAP |
| Right median abductor pollicis brevis | Reduced CMAP amplitude compared to contralateral side (thought to be incidental from known prior trauma). |
| Left ulnar abductor digiti minimi | Reduced CMAP amplitude compared to right side. Normal distal latency and conduction velocity. |
| Right ulnar abductor digiti minimi | Normal CMAP |

**EMG studies**

| Left first dorsal interosseous | Increased insertion activity. Normal recruitment, normal motor unit action potentials. |
| Left extensor indicis proprius | Mildly reduced recruitment. Normal motor unit action potentials. |
| Left flexor digitorum profundus 4 | Severely reduced recruitment. Normal motor unit action potentials. |
| Left C8 paraspinal muscles      | Normal |
| Left infraspinatus              | Normal |
| Left deltoid                    | Normal |
| Left pronator teres             | Normal |
| Left extensor digitorum communis | Normal |

SNAP: Sensory nerve action potential, CMAP: Compound muscle action potential, EMG: Electromyogram
| Publication                  | Age | Sex   | Vaccine          | Vaccination site | Affected extremity | MRI          | EMG/NCS findings                                                                                     | Treatment                     |
|-----------------------------|-----|-------|------------------|------------------|-------------------|--------------|-----------------------------------------------------------------------------------------------------|-------------------------------|
| Diaz-Segarra et al., 2021[12] | 35  | Female | Pfizer-BioNtech  | Right deltoid    | Left upper        | NA          | Reduced SNAP of lateral antebrachial cutaneous nerve. Active demyelination of peripheral nerves with C5–6 root contributions. | High-dose prednisone          |
| Mahajan et al., 2021[28]    | 50  | Male  | Pfizer-BioNtech  | Left deltoid     | Left upper        | Reported as normal | Decreased motor unit recruitment in the left first dorsal interosseus, extensor digitorum, extensor digiti minimi, abductor digiti minimi, and flexor carpi ulnaris. | High-dose prednisone          |
| Queler et al., 2021[33]     | 49  | Male  | Pfizer-BioNtech  | Right deltoid    | Left upper        | Abnormal     | Normal at 9 days post symptom onset. Repeat at 8 weeks with severe denervation and no motor unit recruitment in pronator teres and flexor carpi radialis. | Prednisone taper               |
| Queler et al., 2021[33]     | 44  | Male  | ModernaTX        | Left deltoid     | Left upper        | Normal at 24 days post symptom onset. Abnormal at 5 weeks. | Decreased motor unit recruitment in infraspinatus. | Gabapentin + physical therapy |
| Coffman et al., 2021[9]     | 66  | Female | Pfizer-BioNtech  | Right deltoid    | Right upper       | NA          | Mild chronic neuropathic changes in serratus anterior. Decreased action potential amplitude in the left axillary, musculocutaneous, median, and radial nerves. Fibrillations and positive waves in extensor digitorum communis, abductor digiti minimi, first dorsal interosseus, and abductor pollicis brevis. | Physical therapy               |
| Burillo et al., 2021[7]     | 38  | Male  | AstraZeneca      | Not reported     | Left upper        | Mild left subacromial tendinopathy, otherwise reported as normal. | Initial NCS normal. Initial EMG with decreased motor unit recruitment. One month post onset with denervation in the left vastus medialis and iliopsoas, decreased motor unit recruitment in the left leg, axonal and demyelinating lumbosacral plexopathy. Reported as normal at 10 and 31 days post onset. | IV methylprednisolone followed by high-dose prednisolone |
| Kim et al., 2021[24]        | 45  | Female | AstraZeneca      | Left deltoid     | Left lower        | Initial with mild L4–5 disc protrusion, otherwise reported as normal. One month post onset abnormal. | High-dose prednisolone        |}

(Contd...)
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Many patients will go on to develop sensory deficits including paresthesias and hypoesthesia and can also have muscle atrophy. Symptoms are usually self-limited and resolve slowly over several months, with complete resolution in majority of patients at 2–3 years.\textsuperscript{[19,43]} Differential diagnosis of PTS includes focal extremity pathologies including subacromial bursitis, facioscapulohumeral dystrophy, adhesive capsulitis, or other nervous pathologies including radiculopathy, entrapment neuropathies, multifocal motor neuropathy, hereditary neuropathy, and mononeuritis multiplex.\textsuperscript{[25,45]}

EMG, NCS, and MRI can help confirm the diagnosis of PTS.\textsuperscript{[14,34,38]} Routine NCS can be normal but may have low amplitudes in affected segments; rarely, proximal conduction block can be demonstrated. EMG typically shows signs of denervation and reduced recruitment, at times even in clinically unaffected muscles, MRI is helpful and is evaluating for PTS as it can show diffuse T2-weighted signal changes secondary to denervation and edema of the muscles in the distribution of the affected brachial plexus nerves.\textsuperscript{[5,20,34]}

Similarly, in our case, EMG showed evidence of the left lower trunk denervation, supported by MRI findings of edema and inflammation of muscles along the inferior brachial plexus. There is no consensus on the treatment of PTS, but generally involves conservative measures including analgesia, corticosteroid treatment, and physical therapy.\textsuperscript{[15]} A proposed protocol for corticosteroid treatment is oral prednisone at 1 mg/kg/day for 1–2 weeks followed by a taper to off over an additional 1–2 weeks.\textsuperscript{[15,42]}

At the time of writing, there are only nine other published case reports of PTS post-COVID vaccination [Table 2]. Our case is similar in that we find NCS/EMG changes in the affected extremity as well as similar MRI findings. A postulated mechanism of the development of PTS after COVID vaccination could be related to a reactive inflammatory response. Further studies investigating post-COVID vaccination PTS would be helpful in better understanding its pathogenesis. A limitation of a case report such as this includes lack of generalizability and inability to directly

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**Table 2: (Continued).**

| Publication  | Age | Sex | Vaccine          | Vaccination site | Affected extremity | MRI | EMG/NCS findings | Treatment                      |
|--------------|-----|-----|------------------|------------------|-------------------|-----|-----------------|--------------------------------|
| Koh et al., 2021\textsuperscript{[26]} | 44  | Male| Pfizer-BioNtech  | Left deltoid     | Right upper       | Abnormal | Brachial plexus lower trunk involvement. | Not reported, did not receive steroids. |
| Koh et al., 2021\textsuperscript{[26]} | 58  | Male| ModernaTX        | Left deltoid     | Left upper        | Abnormal | Brachial plexus lower trunk involvement. | Corticosteroids                  |
| Vitturi et al., 2021\textsuperscript{[45]} | 51  | Male| AstraZeneca      | Left deltoid     | Left upper        | NA    | Reinnervation of deltoid, biceps brachii, triceps brachii, infraspinatus, extensor pollicis longus, extensor pollicis brevis, first interosseous. Decreased action potential amplitude of the left axillary nerve. | NSAID, pregabalin + physical therapy |

**Figure 1:** (a-d) Magnetic resonance imaging of the brachial plexus. T1 precontrast (a), T1 postcontrast (b), T2 (c), and STIR (d) demonstrating increased STIR signal, T2-weighted signal, and mild T1 postcontrast enhancement of the medial left scalene muscles along the inferior brachial plexus consistent with inflammatory changes and intramuscular edema (yellow arrows).

EMG: Electromyogram, NCS: Nerve conduction study, SNAP: Sensory nerve action potential
determine a cause-and-effect relationship. However, as more case reports arise, we can establish a likely association. Given the limited nature of the course of PTS, the authors still feel that the benefit of the COVID-19 vaccination continues to highly outweigh any associated risks.

CONCLUSION

We present a case of post-COVID-19 vaccination PTS which improved following a corticosteroid taper and conservative measures. This is important as short-term shoulder soreness is a common post-COVID-19 vaccination, however, PTS should be in the differential if a patient continues to experience shoulder pain and develops weakness or sensory changes in the extremity.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Allan SG, Towla HM, Smith CC, Downie AW, Clark JC. Painful brachial plexopathy: An unusual presentation of polyarteritis nodosa. Postgrad Med J 1982;58:311-3.
2. Alvarado M, Lin-Miao Y, Carrillo-Arolas M. Parsonage-Turner syndrome post-infection by SARS-CoV-2: A case report. Neurologia (Engl Ed) 2021;36:568-71.
3. Alvarez A, Amirianfar E, Mason MC, Huang L, Jose J, Tiu T. Extended neuralgic amyotrophy syndrome in a confirmed COVID-19 patient after intensive care unit and inpatient rehabilitation stay. Am J Phys Med Rehabil 2021;100:733-6.
4. Bloch SL, Jarrett MP, Swerdlow M, Grayzel AI. Brachial plexus neuropathy as the initial presentation of systemic lupus erythematosus. Neurology 1979;29:1633-4.
5. Bredella MA, Tirman PF, Fritz RC, Wischer TK, Stork A, Genant HK. Denervation syndromes of the shoulder girdle: MR imaging with electrophysiologic correlation. Skeletal Radiol 1999;28:567-72.
6. Brown R, O'Callaghan J, Peter N. Parsonage-Turner syndrome caused by Staphylococcus aureus spondylodiscitis. BMJ Case Rep 2020;13:e233073.
7. Burillo JA, Martinez CL, Arguedas CG, Pueyo FJ. Amyotrophic neuralgic secondary to Vazquez (AstraZeneca) COVID-19 vaccine. Neurologia (Engl Ed) 2021;36:571-2.
8. Cacciavillani M, Salvalaggio A, Briani C. Pure sensory neuralgic amyotrophy in COVID-19 infection. Muscle Nerve 2021;63:E7-8.
9. Coffman JR, Randolph AC, Somerson JS. Parsonage-Turner syndrome after SARS-CoV-2 BNT162b2 vaccine: A case report. JBJS Case Connect 2021;11:e21.00370.
10. Coll C, Tessier M, Vandendries C, Seror P. Neuralgic amyotrophy and COVID-19 infection: 2 cases of spinal accessory nerve palsy. Joint Bone Spine 2021;88:105196.
11. Diaz C, Contreras JJ, Muñoz M, Osorio M, Quiroz M, Pizarro R. Parsonage-Turner syndrome association with SARS-CoV-2 infection. JSES Rev Rep Tech 2021;1:252-6.
12. Diaz-Segarra N, Edmond A, Gilbert C, Mckay O, Kloepping C, Vonclas P. Painless idiopathic neuralgic amyotrophy after COVID-19 vaccination: A case report. PM R 2021;1:3.
13. Dreschfeld J. On some of the rarer forms of muscular atrophies. Brain 1886;9:178-95.
14. Feinberg JH, Nguyen ET, Boachie-Adjei K, Gribbin C, Lee SK, Daluiski A, et al. The electrodiagnostic natural history of parsonage-turner syndrome. Muscle Nerve 2017;56:737-43.
15. Feinberg JH, Radecki J. Parsonage-turner syndrome. HSS J 2010;6:199-205.
16. Fibuch EE, Mertz J, Geller B. Postoperative onset of idiopathic brachial neuritis. Anesthesiology 1996;84:455-8.
17. Flikkema K, Brossky K. Parsonage-Turner syndrome after COVID-19 vaccination: A case report. JBJS Case Connect 2021;11:e21.00577.
18. Franse DP, Schönhuth CP, Postma TJ, van Royen BJ. Parsonage-Turner syndrome following post-exposure prophylaxis. BMC Musculoskelet Disord 2014;15:265.
19. Gonzalez-Alegre P, Recober A, Kelkar P. Idiopathic brachial neuritis. Iowa Orthop J 2002;22:81-5.
20. Helms CA, Martinez S, Speer KP. Acute brachial neuritis (Parsonage-Turner syndrome): MR imaging appearance--report of three cases. Radiology 1998;207:255-9.
21. Ismail II, Abdelnabi EA, Al-Hashel JY, Alroughani R, Ahmed SE. Neuralgic amyotrophy associated with COVID-19 infection: A case report and review of the literature. Neurol Sci 2021;42:2161-5.
22. Jacob JC, Andermann F, Robb JP. Heredofamilial neuritis with brachial predilection. Neurology 1961;11:1025-33.
23. James JL, Miles DW. Neuralgic amyotrophy: A clinical and discussion of clinical features with review of 23 cases. JAMA 1960;174:1258-62.
24. Kim SI, Seok HY, Yi J, Cho JH. Leg paralysis after AstraZeneca COVID-19 patient after intensive care unit and inpatient rehabilitation stay. Am J Phys Med Rehabil 2021;100:733-6.
25. Kim SI, Seok HY, Yi J, Cho JH. Leg paralysis after AstraZeneca COVID-19 vaccination: A case report. PM R 2021;1-3.
26. Magee KR, Dejong RN. Paralytic brachial neuritis. Discussion of clinical features with review of 23 cases. JAMA 1960;174:1258-62.
27. Mahajan S, Zhang F, Mahajan A, Zimnowodzki S. Parsonage Turner syndrome after COVID-19 vaccination. Muscle Nerve 2021;14:58-67.
28. Martin WA, Kraft GH. Shoulder girdle neuritis: A clinical and electrophysiologic evaluation. Mil Med 1974;139:21-5.
29. Martin WA, Kraft GH. Shoulder girdle neuritis: A clinical and electrophysiologic evaluation. Mil Med 1974;139:21-5.
30. Mitry MA, Collins LK, Kazam JJ, Kaicker S, Kovanlikaya A.
Parsonage-turner syndrome associated with SARS-CoV2 (COVID-19) infection. Clin Imaging 2021;72:8-10.

31. Parsonage MJ, Turner JW. Neuralgic amyotrophy; the shoulder-girdle syndrome. Lancet 1948;1:973-8.

32. Pellegrino JE, Rebbeck TR, Brown MJ, Bird TD, Chance PF. Mapping of hereditary neuralgic amyotrophy (familial brachial plexus neuropathy) to distal chromosome 17q. Neurology 1996;46:1128-32.

33. Queler SC, Towbin AJ, Milani C, Whang J, Sneag DB. Parsonage-Turner syndrome following COVID-19 vaccination: MR Neurography. Radiology 2022;302:84-7.

34. Scalf RE, Wenger DE, Frick MA, Mandrekar JN, Adkins MC. MRI findings of 26 patients with Parsonage-Turner syndrome. AJR Am J Roentgenol 2007;189:W39-44.

35. Schmitt M, Daubail B, Bohm A. Parsonage-Turner syndrome secondary to Lyme disease. Joint Bone Spine 2018;85:387-8.

36. Shaikh MF, Baqai TJ, Tahir H. Acute brachial neuritis following influenza vaccination. BMJ Case Rep 2018;2018:bcr2012007673.

37. Siepmann T, Kitzler HH, Lueck C, Platzek I, Reichmann H, Barlinn K. Neuralgic amyotrophy following infection with SARS-CoV-2. Muscle Nerve 2020;62:1E68-70.

38. Sneag DB, Rancy SK, Wolfe SW, Lee SC, Kalia V, Lee SK, et al. Brachial plexitis or neuritis? MRI features of lesion distribution in Parsonage-Turner syndrome. Muscle Nerve 2018;58:359-66.

39. Stek CJ, van Eijk JJ, Jacobs BC, Enting RH, Sprenger HG, van Alfen N, et al. Neuralgic amyotrophy associated with Bartonella henselae infection. J Neurol Neurosurg Psychiatry 2011;82:707-8.

40. Taylor RA. Heredofamilial mononeuritis multiplex with brachial predilection. Brain 1960;83:113-37.

41. Tsairis P, Dyck PJ, Mulder DW. Natural history of brachial plexus neuropathy. Report on 99 patients. Arch Neurol 1972;27:109-17.

42. van Alfen N, van Engelen BG, Hughes RA. Treatment for idiopathic and hereditary neuralgic amyotrophy (brachial neuritis). Cochrane Database Syst Rev 2009;2009:CD006976.

43. van Alfen N. Clinical and pathophysiological concepts of neuralgic amyotrophy. Nat Rev Neurol 2011;7:315-22.

44. Viatgé T, Noel-Savina E, Prévot G, Faviez G, Plat G, De Boissezon X, et al. Parsonage-Turner syndrome following severe SARS-CoV-2 infection. Rev Mal Respir 2021;38:853-8.

45. Vitturi BK, Grandis M, Beltramini S, Orsi A, Schenone A, Icardi G, et al. Parsonage-Turner syndrome following coronavirus disease 2019 immunization with ChAdOx1-S vaccine: A case report and review of the literature. J Med Case Rep 2021;15:589.

46. Wendling D, Sevrin P, Bouchaud-Chabot A, Chabroux A, Toussirot E, Bardin T, et al. Parsonage-Turner syndrome revealing Lyme borreliosis. Joint Bone Spine 2009;76:202-4.

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