

Vestibular neuronitis after COVID-19 vaccination

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SUMMARY

A woman in her 50s presented with acute vertigo and vomiting within 72 hours of receiving the Pfizer-BioNTech COVID-19 vaccine. The only neurological deficit was an impaired vestibulo-ocular reflex with horizontal nystagmus. The patient was subsequently diagnosed with vestibular neuronitis. She was managed symptomatically with prochlorperazine and betahistine, and underwent vestibular rehabilitation for 6 weeks. She made a full recovery and experienced no further symptoms. She received the second dose of the vaccine without complications.

This case demonstrates a temporal association between COVID-19 vaccination and vestibular neuronitis. Neurological adverse events are rare but recognised side effects of COVID-19 vaccines and healthcare professionals should be aware of them. This ensures timely management of patients with such presentations. Treatment should be the same as for non-vaccine-associated vestibular neuronitis. The nature of the relationship between COVID-19 vaccination and vestibular neuronitis remains unclear and patients therefore require investigations to exclude other recognised causes of vestibular neuronitis.

BACKGROUND

SARS-CoV-2 ('COVID-19') first emerged in late 2019 and has so far claimed over 6 million lives. Several vaccines were rapidly developed and tested to limit the spread of the disease and deaths. COVID-19 vaccination is now required in many countries to attend events and travel. Billions of people worldwide are being vaccinated against COVID-19 and a good understanding of possible side effects of these vaccines is crucial in ensuring patients are appropriately investigated and optimally treated.

There are multiple causes of acute vertigo with vomiting. This case report aims to explain the various clinical presentations and treatments of the possible underlying conditions, as well as detailing how one can arrive at a specific diagnosis through history-taking, clinical examination and appropriate investigations.

CASE PRESENTATION

A female patient in her 50s presented to the emergency department with a 1-day history of sudden-onset, progressive vertigo. The vertigo was continuous, improved when supine and disappeared when closing her eyes. The patient reported nausea and vomiting, an unsteady gait, light-headedness and drowsiness. She denied any hearing loss, ear discharge or tinnitus. She had felt completely well before the sudden onset of symptoms. The episode began less than 72 hours

after her first dose of the Pfizer COVID-19 vaccine. She had never previously tested positive for coronavirus, or experienced any of its typical symptoms.

Her medical history consisted of hypertension for which she took amlodipine and ramipril. There was no relevant personal or family history. She had never previously experienced a similar episode.

On examination, the chest was clear and heart sounds were normal. The patient was haemodynamically stable and afebrile. Vomiting and vertigo were induced by movement and so the patient aimed to remain still in bed. The head impulse test demonstrated an impaired vestibulo-ocular reflex with horizontal nystagmus to the right, and triggered significant nausea and vomiting in the patient. There were no other neurological deficits.

INVESTIGATIONS

Bloods demonstrated a leucocytosis ($14.3 \times 10^9/L$) with neutrophilia ($13 \times 10^9/L$) and lymphopenia ($0.8 \times 10^9/L$). Alanine aminotransferase and alkaline phosphatase were both elevated. Notably, the C-reactive protein (CRP) was normal and other blood work was unremarkable. A chest radiograph and COVID-19 test were negative. A brain MRI was normal.

DIFFERENTIAL DIAGNOSIS

New-onset, acute and persistent vertigo with significant vomiting has several possible aetiologies. The main diagnoses considered for this patient's presentation have been summarised in [table 1](#). These are, in order of frequency, benign paroxysmal positional vertigo (BPPV), vestibular migraine, Meniere's disease, vestibular neuronitis, labyrinthitis and posterior circulation stroke. The most dangerous and time-critical differential diagnosis was posterior circulation stroke. An urgent MRI of her brain was performed to exclude this and was normal. BPPV was unlikely due to the duration and character of the patient's symptoms. BPPV is typically characterised by recurrent episodes lasting seconds to minutes, induced by head movement. The absence of tinnitus or auditory fullness was not in line with a diagnosis of Meniere's disease. Vestibular migraine was deemed unlikely due to the absence of headaches, lack of previous episodes, no aura and a positive head-impulse test. Labyrinthitis and vestibular neuronitis were therefore the most likely explanations of this woman's presentation. The major difference between these two diagnoses is the presence of sensorineural hearing loss and tinnitus in labyrinthitis, which this patient did not have. She was therefore diagnosed with vestibular neuronitis.

TREATMENT

The patient was managed symptomatically with intravenous fluids and prochlorperazine (5 mg,



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Table 1 Summary of the pathogenesis, history, examination and treatment of the five major causes of new onset vertigo

Condition	Benign paroxysmal positional vertigo	Vestibular migraine	Meniere's disease	Vestibular neuronitis	Labyrinthitis	Posterior circulation stroke
Pathogenesis	Accumulation of crystals in the posterior semi-circular canals	Activation of the trigemino-vestibulocochlear reflex	Increased fluid in the endolymph part of the cochlear and semi-circular canals	Inflammation of the vestibular nerve	Inflammation of the labyrinth	Haemorrhage or infarct in the posterior circulation supplying the brainstem and cerebellum
Onset and duration of each episode	Sudden onset. Lasts <1 min.	Lasts between a few minutes and 72 hours	Sudden onset. Lasts hours.	Sudden onset. Lasts seconds to minutes.	Sudden onset. Lasts seconds to minutes.	Sudden or gradual onset. Continuous symptoms.
Duration of illness	Several weeks. Can recur later on in life.	Episodic or chronic	Chronic	Days to weeks	Days to weeks	Minutes to days or weeks
Risk factors	<ul style="list-style-type: none"> ▶ Most commonly idiopathic ▶ Age ▶ Head injury/trauma ▶ Post-vestibular neuronitis 	<ul style="list-style-type: none"> ▶ Female ▶ Childbearing age ▶ Triggers: certain food, stress, lack of sleep 	<ul style="list-style-type: none"> ▶ Unknown aetiology ▶ Female ▶ >40 years old 	<ul style="list-style-type: none"> ▶ Viral URTI ▶ Herpes zoster infection 	<ul style="list-style-type: none"> ▶ Middle ear infection ▶ Viral infection 	<ul style="list-style-type: none"> ▶ Cerebrovascular risk factors, ie, HTN, DM, smoking
History and examination findings	<ul style="list-style-type: none"> ▶ Change in head position ▶ Positional symptoms ▶ No HL or tinnitus ▶ Dix-hallpike positive 	<ul style="list-style-type: none"> ▶ Headache ▶ Sensory aura ▶ Photophobia ▶ Phonophobia ▶ Ear pain ▶ Tinnitus ▶ Aural fullness 	<ul style="list-style-type: none"> ▶ SNHL ▶ Tinnitus ▶ Aural fullness 	<ul style="list-style-type: none"> ▶ Nausea and vomiting ▶ No HL or tinnitus ▶ Head impulse test positive 	<ul style="list-style-type: none"> ▶ SNHL ▶ Tinnitus ▶ Head impulse test positive 	<ul style="list-style-type: none"> ▶ Vertical nystagmus ▶ Direction changing ▶ Usually present with other neurology
Treatment	Epley's manoeuvre	Acute: Paracetamol, NSAIDs or triptans. Prophylaxis: Propranolol, amitriptyline. Vestibular rehabilitation.	Betahistine, diuretics, intratympanic steroid and gentamicin injections. Last line is surgery.	Anti-emetics, vestibular rehabilitation	Anti-emetics, vestibular rehabilitation	Acute stroke care (thrombolysis and/or thrombectomy, anti-platelets, anticoagulants, management of risk factors)

DM, diabetes mellitus; HL, hearing loss; HTN, hypertension; NSAIDs, non-steroidal anti-inflammatory drugs; SNHL, sensorineural hearing loss; URTI, upper respiratory tract infection.

three times a day). She was discharged 2 days after her admission, at which point she felt 50%–60% better. The patient underwent 6 weeks of vestibular rehabilitation. After discharge from hospital, the general practitioner (GP) replaced prochlorperazine with betahistine. She had recovered to 80% by 2 weeks and completely by 8 weeks.

OUTCOME AND FOLLOW-UP

The episode of vertigo has not recurred. She also experienced no further nausea or vomiting. The patient received the second Pfizer-BioNTech vaccination 2 months later and reported no side effects afterwards.

DISCUSSION

Neurological side effects of COVID-19 vaccines

Several vaccines have been developed against SARS-CoV-2 in response to the COVID-19 pandemic. The Pfizer-BioNTech was the first vaccine approved for emergency use. The vaccine consists of messenger RNA (mRNA) encapsulated in a lipid nanoparticle which stimulates innate production of the SARS-CoV-2 spike protein, in turn resulting in an immune response producing SARS-CoV-2-specific antibodies.¹ Several other vaccines have since been approved for emergency use.

Vaccines can cause local or generalised side effects. Neurological side effects have been reported for several of the COVID-19 vaccines. The Pfizer-BioNTech vaccine's safety and efficacy were tested in a global, placebo-controlled, blinded, randomised controlled trial with 43 252 participants. The most common side effects were mild-moderate pain at the injection site, fatigue and headache. Other neurological side effects included Bell's palsy (four participants in vaccine group vs 0 in placebo group) and one vaccine recipient experienced right leg paraesthesia. Monitoring for adverse events will continue for 2 years.¹ Since its administration to the general population, other neurological presentations have been reported. A case of Guillain-Barré syndrome was described in an 82-year-old woman within 2 weeks of receiving

the Pfizer-BioNTech vaccine. The patient did not experience any respiratory symptoms and was managed with intravenous immunoglobulin, physical therapy and discharged to a neurorehabilitation facility.² A case series reported a further nine patients who developed Bell's palsy after receiving the Pfizer-BioNTech vaccination.³

Neurological side effects have also been associated with other COVID-19 vaccines. Most notably, there has been increasing evidence of an association between venous thromboemboli and the AstraZeneca vaccine, which resulted in reconsideration of immunisation programmes across Europe and Canada.⁴ There have also been cases of transverse myelitis after Astrazeneca vaccination during the phase III clinical trial.⁵

Vestibular neuronitis after vaccination

In the Vaccine Adverse Event Reporting System (VAERS), 11.8% of the reports cited dizziness as a possible side effect of COVID-19 vaccinations.⁶ An additional 0.8% listed vertigo and 1.27% reported syncope.⁶ Dizziness is more frequently associated with the AstraZeneca than the Pfizer-BioNTech vaccine. The UK Medicines and Healthcare products Regulatory Agency listed dizziness as a side effect for the Astrazeneca vaccine, not for other COVID-19 vaccines.⁷

There has been one previous report of a patient developing vestibular neuronitis after receiving the Pfizer-BioNTech COVID-19 vaccine.⁸ The patient was a man, but similar to the present report, was also middle-aged with well-controlled hypertension. The range of symptoms varied between the two patients. The man was stated to only suffer from vertigo, while our patient's symptoms included persistent nausea and vomiting, gait disturbance, light-headedness and drowsiness, alongside the vertigo. Both patients took 6–8 weeks to recover. Similar to the previously published report, clinical findings pointed away from a central pathology underlying this presentation. Additionally, we performed a brain MRI to radiologically exclude a central cause for these symptoms, especially in

light of the patient's history of hypertension. We also discussed the differential diagnoses that could account for this presentation and have explained how a diagnosis of vestibular neuronitis was ultimately achieved. There has also been a report of vestibular neuronitis in a female patient after the AstraZeneca vaccine, who made a full recovery.⁸

Other audiovestibular disorders have been reported after COVID-19 vaccination, such as sensorineural hearing loss in the days following vaccination, with patients making a full⁹ or partial¹⁰ recovery.

Vestibular neuronitis

Vestibular neuronitis is usually benign and self-limiting.¹¹ It differs from labyrinthitis in that there is no associated hearing loss although patients may occasionally complain of tinnitus.¹² It is a diagnosis of exclusion as no confirmatory investigations exist.¹² Table 1 provides a summary of the history, examination findings and treatment.

The aetiology remains unclear. There is evidence that supports an infective cause whereby inflammation and oedema of the nerve occurs due to current viral infection¹³ or reactivation of latent HSV-1 in the vestibular ganglia,¹⁴ similar to Bell's palsy. An alternative theory proposes that vestibular neuronitis occurs as an 'immune-mediated complication of infection, rather than direct infection of the nerve'.¹⁵ Immune-mediated neurological disease is a well-established complication of infection¹⁵ and has even been identified among patients with COVID-19, such as encephalitis and polyradiculitis.¹⁶ Aside from this, immune-induced peripheral neuropathy has been found to follow vaccination, as evidenced by brachial neuropathy following deltoid vaccination.¹⁵ Furthermore, immunological theories have been proposed as the aetiology of vestibular neuronitis following influenza vaccination.¹⁵

Our case demonstrates a temporal association between the Pfizer-BioNTech vaccine and vestibular neuronitis. Given the above evidence, we hypothesise that vestibular neuronitis may be an immune-mediated complication of COVID-19 vaccination. Previously, it has been hypothesised that cross-reactivity between the COVID-19 vaccine and host immune cells may contribute to the development of audiovestibular disorders, including vestibular neuronitis.¹⁷ Molecular mimicry between anti-spike COVID-19 antibodies, developed after COVID-19 vaccination, and ear antigens, may explain potential cross-reactivity reactions underlying adverse events.¹⁷ However, this case does not

provide any evidence of a causal link between COVID-19 vaccination and vestibular neuronitis, and neither does any existing literature.

This case report describes a case of vestibular neuronitis temporally related to COVID-19 vaccination and should not prohibit patients from accessing COVID-19 vaccination. The nature of the association remains to be understood, but it is important for clinicians to be aware of this potential association. Further research is needed to better understand the relationship between COVID-19 vaccination and vestibular neuronitis.

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Case reports provide a valuable learning resource for the scientific community and can indicate areas of interest for future research. They should not be used in isolation to guide treatment choices or public health policy.

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Learning points

- ▶ Neurological adverse events are rare but recognised side effects of COVID-19 vaccines.
- ▶ Vestibular neuronitis may present in patients who have recently been vaccinated and should be treated similarly to non-vaccine-associated vestibular neuronitis.
- ▶ The main causes of vertigo can be distinguished using the history and examination findings.

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