Sudden sensorineural hearing loss with intralabyrinthine hemorrhage after COVID-19 vaccination

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ABSTRACT

Otolologic symptoms of sudden sensorineural hearing loss (SSNHL) have been reported after Coronavirus disease 2019 (COVID-19) vaccinations. However, the association between SSNHL and COVID-19 vaccination has not been clearly established. SSNHL with vertigo can be induced by intralabyrinthine hemorrhage (ILH). The case of a 61-year-old female who was diagnosed SSNHL with ILH after COVID-19 vaccination is presented here. She visited the emergency department for left sudden hearing loss and vertigo that had occurred the previous day. She had received a third booster COVID-19 mRNA vaccination one day prior to the visit; symptoms occurred 6 hours after vaccination. On pure tone audiometry, her hearing threshold indicated deafness in the left ear. A lesion assumed to be ILH was observed on temporal magnetic resonance imaging. She received an oral steroid followed by salvage treatment with intratympanic steroid injection. Three months after symptom onset, her hearing threshold remained deaf with slight improvement at low frequencies in the left ear. Because the symptoms of and prognosis for SSNHL may be worse and vertigo may occur in patients with SSNHL and ILH, careful treatment is required.

INTRODUCTION

Serious rare adverse events have been reported following Coronavirus disease 2019 (COVID-19) vaccination, including Guillain-Barré syndrome, thrombosis with thrombocytopenia syndrome after adenovirus-vector vaccination, and myocarditis after mRNA vaccination. In addition, otologic symptoms of sudden sensorineural hearing loss (SSNHL) have been reported after COVID-19 vaccination. SSNHL is defined as sudden hearing loss of 30 dB or more at three consecutive frequencies within three days. The etiology of SSNHL is often idiopathic, but it can occur due to viral infection, vasculitis, autoimmune disease, or tumor. However, the association between SSNHL and COVID-19 vaccination has not been elucidated.

SSNHL with vertigo can be induced by intralabyrinthine hemorrhage (ILH). The cause of ILH is generally considered to be hemorrhagic diathesis, with trauma, aplastic anemia, sickle cell disease, leukemia, metastatic malignancy, Wegener’s granulomatosis, and intracranial hemorrhage as other potential causes. The case of a 61-year-old female who was diagnosed SSNHL with ILH after COVID-19 vaccination is presented here.

CASE PRESENTATION

A 61-year-old female visited the emergency department with left sudden hearing loss and vertigo that had occurred the previous day. She had received first and second COVID-19 vaccinations (Pfizer-BioNTech mRNA vaccine) with no adverse events. However, she had received a third booster vaccination of Pfizer-BioNTech COVID-19 vaccine one day prior to presentation; symptoms occurred 6 hours after vaccination. She had a history of hypertension and dyslipidemia, and blood pressure and lipid levels were well controlled with valsartan and rosuvastatin, respectively. Blood tests including complete blood count, chemistry, and coagulation tests such as prothrombin time and activated partial thromboplastin time were normal. On pure tone audiometry, her hearing threshold with a weighted four-frequency average ([500 Hz +1000 Hz x 2 + 2000 Hz x 2 + 4000 Hz] / 6) was 32 dB on the right and indicated deafness on the left (Figure 1). She showed no spontaneous, gazing, head shaking, or positioning nystagmus. She was admitted to the hospital due to severe vertigo. She received an oral steroid (prednisolone 60 mg per day for five days, which was tapered for the next five days) and oral vestibular suppressants such as dimenhydrinate and diazepam. On temporal magnetic resonance imaging (MRI), there were no abnormal lesions in the internal auditory canal. However, an abnormal hyperintense lesion was observed in the left cochlea and vestibule on T1-weighted imaging, which was not enhanced on T1-weighted imaging with contrast (Figure 2). There were no lesions at other sites of the inner ear or brain. Thus, the lesion was assumed to be ILH based on MRI.

After administration of an oral steroid, her hearing threshold with a weighted four-frequency average still indicated deafness on the left. Thus, salvage treatment with intratympanic steroid injection (dexamethasone 5 mg every third day for five cycles) was performed. After three months, her hearing threshold with a weighted four-frequency average still indicated deafness with slight improvement at low frequencies of 125 and 250 Hz on the left. However, vertigo has improved without nystagmus.
Although previous reports exist about SSNHL after vaccination for several diseases including COVID-19, the etiology remained unclear. Reactivation of previous latent viruses is possible, resulting in SSNHL due to a response similar to Ramsay-Hunt syndrome or Bell’s palsy. In addition, immunologic and inflammatory responses could result in vasculitis and vascular ischemia of the cochlea. Vascular compromise in the inner ear due to hemorrhage, thrombosis, and vasospasm can also result in cochlear ischemia and SSNHL.

The etiology of ILH in the present case should be considered carefully. Similar to ILH after COVID-19 vaccination, a case of intracerebral hemorrhage due to vasculitis after COVID-19 vaccination was reported, although the etiology was unclear. ILH may induce SSNHL with vertigo in patients with underlying coagulopathy such as anticoagulant therapy or hematologic diseases. However, ILH can also occur idiopathically without a history of anticoagulation medication. Injuries to the cochlear microcirculation such as ILH can lead to defects in endocochlear potential, ion transport, and endolymphatic fluid balance, which are essential for normal hearing function. It has been suggested that coagulopathy associated with COVID-19 consists of low-grade disseminated intravascular coagulation and pulmonary thrombotic microangiopathy. In COVID-19 vaccination, a similar possible etiology to that in COVID-19 could be considered because of the presence of a viral antigen after vaccination. However, the occurrence of ILH on the day of COVID-19 vaccination in the present case makes an immunologic mechanism improbable considering the very short period, which was unlikely to be sufficient for an autoimmune reaction. Thus, the etiology or relationship to vaccination in the present case is uncertain.

ILH can be confirmed with MRI as high signal intensity on T1-weighted imaging that is not enhanced with gadolinium. SSNHL patients with ILH seem to exhibit worse symptoms of hearing loss and prognosis than those with other etiologies. In the present case, the patient had not been using anticoagulant medications, and platelet count and blood coagulation tests such as prothrombin time and activated partial thromboplastin time were normal. The differences between the present and previous cases with SSNHL after COVID-19 vaccination are the more severe initial symptoms and worse prognosis in the present case. The initial hearing threshold in the affected side indicated deafness and the patient experienced vertigo. In addition, the hearing threshold still indicated deafness with incomplete recovery after treatment with an oral steroid and intratympanic steroid injection, which are optimal treatments, as in SSNHL without ILH. The relationship between SSNHL with ILH and COVID-19 vaccine type is unclear because this is the first report of SSNHL with ILH after COVID-19 vaccination.

The treatment of SSNHL after COVID-19 vaccination is the same as that in the absence of the vaccine, which is corticosteroid administration. To prevent insufficient immunization due to drug-vaccine interactions, intratympanic steroid can be considered rather than systemic steroid administration.
Because the symptoms of and prognosis for SSNHL may be worse and vertigo can occur in patients with SSNHL and ILH, careful treatment is required.

SSNHL with ILH after COVID-19 vaccination should be considered in patients with severe symptoms of sudden hearing loss and vertigo. However, the association between SSNHL with ILH and COVID-19 vaccination remains unclear, and further research is necessary.

Acknowledgments
The authors thank the patient for contribution to the case report.

Disclosure statement
No potential conflict of interest was reported by the author(s).

Funding
This work was supported by a National Research Foundation of Korea grant funded by the Korean government (Ministry of Science and ICT; 2019R1F1A1062649)

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Ethical approval
The Institutional Review Board of the National Health Insurance Service Ilsan Hospital exempted the review of this study (NHIMC 2022-01-028). Written informed consent was waived by the Institutional Review Board because of the retrospective nature of the study.

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