CASE REPORT

Sudden onset unilateral sensorineural hearing loss after rabies vaccination

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SUMMARY

A 33-year-old man developed profound sudden onset right-sided hearing loss with tinnitus and vertigo, within 24 h of pretravel rabies vaccination. There was no history of upper respiratory tract infection, systemic illness, ototoxic medication or trauma, and normal otoscopic examination. Pure tone audiograms (PTA) demonstrated right-sided sensorineural hearing loss (thresholds 90–100 dB) and normal left-sided hearing. MRI internal acoustic meatus, viral serology (hepatitis B, C, HIV and cytomegalovirus) and syphilis screen were normal. Positive Epstein-Barr virus IgG, viral capsid IgG and anticonchlear antibodies (anti-HSP-70) were noted. Initial treatment involved a course of high-dose oral prednisolone and acyclovir. Repeat PTAs after 12 days of treatment showed a small improvement in hearing thresholds. Salvage intratympanic steroid injections were attempted but failed to improve hearing further. Sudden onset sensorineural hearing loss (SSNHL) is an uncommon but frightening experience for patients. This is the first report of SSNHL following rabies immunisation in an adult.

BACKGROUND

Sudden onset sensorineural hearing loss (SSNHL) is an uncommon but frightening experience for patients. The exact incidence is unclear and estimates range from 5 to 20/100 000 population/year.¹ It is defined as a rapid onset of a subjective sensation of hearing impairment in one or both ears that develops over a period of 72 h. This can be confirmed by audiological findings of reduced sensorineural hearing of ≥ 30 decibels (dB) over three consecutive frequencies.¹

SSNHL is an ear, nose and throat (ENT) emergency requiring prompt appropriate investigation and management. Attributable causes for SSNHL are rare, with up to 90% of cases being idiopathic in aetiology.¹

However, cases of SSNHL after immunisation with commonly used vaccines such as hepatitis B, measles and, more recently, H1N1, have been reported in the literature.^{2–4}

The mechanism responsible for this remains unclear. It is postulated that the viral antigen–antibody complex results in a hypersensitivity reaction, which causes localised inflammation and damage to the cochlea, resulting in hearing loss.^{1,2}

To date, there has been one paediatric case of SSNHL following rabies vaccination reported in the literature.⁵ We report the first adult case of SSNHL following rabies immunisation and discuss the management of this rare clinical entity.

CASE PRESENTATION

A 33-year-old man was referred to our department after assessment at a district general hospital, with symptom of sudden onset right-sided hearing loss. Symptoms began within 24 h of receiving his second dose of rabies pretravel vaccination (Verorab). The patient first noticed gradually worsening tinnitus, prior to the onset of hearing loss, with associated severe vertigo and feeling generally unwell. He had no history of recent head injury, upper respiratory tract infection, or ototoxic medications, and was pain free. He was known to have diet-controlled type 2 diabetes mellitus and atopy. He had no regular medications and no known drug allergies. He had been started on high-dose prednisolone, acyclovir and betahistine by the referring district general hospital's ENT department.

Otoscopic examination confirmed normal external auditory canals and tympanic membranes bilaterally. There was no focal neurology.

INVESTIGATIONS

- Pure tone audiogram demonstrated normal hearing thresholds in the left ear and a profound hearing loss in the right ear (figure 1), with normal (type A) tympanograms.
- An MRI scan of the head demonstrated normal intracranial appearances; specifically, no abnormalities were seen at the internal auditory meatus or cerebellopontine angles.
- Full blood count, biochemistry and inflammatory markers were normal and viral serology markers for cytomegalovirus, HIV, hepatitis B and C and syphilis serology, were negative.
- Epstein-Barr virus (EBV) nuclear antigen IgG and viral capsid IgG were positive, suggesting previous EBV infection.
- An autoimmune screen was performed and although negative for antinuclear antibodies, demonstrated a positive reaction for anticonchlear antibodies (anti-HSP-70).

DIFFERENTIAL DIAGNOSIS

SSNHL secondary to rabies immunisation.

TREATMENT

- The patient completed a 12-day course of oral prednisolone (60 mg) and acyclovir. Repeated pure tone audiograms showed a slight improvement in the hearing threshold in the higher frequencies to 35 and 25 dB at 6 and 8 kHz, respectively (figure 2).

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Figure 1 Pure tone audiogram on day 1 immediately after onset of symptoms.

- After discussion with the patient, salvage intratympanic (IT) steroid injections with solumedrol were started. Two injections were performed, 7 days apart, in line with departmental guidelines.

OUTCOME AND FOLLOW-UP

- Repeat audiograms did not show any additional improvements (figure 3) and the patient was referred for audio-vestibular assessment and tinnitus therapy.
- After 2 months, the patient reported a slight subjective improvement in his hearing, and the tinnitus had resolved.

DISCUSSION

SSNHL after immunisation with commonly used vaccines have been reported in the literature, but we present the first case of SSNHL in an adult after rabies immunisation.²⁻⁴

Vaccination plays a vital role in prevention and control of viral diseases, and transfer immunity, by exposing the immune system to antigens and stimulating the acquired immune system. Rabies is an acute viral zoonotic disease that is transmitted from infected animals and rapidly moves along the peripheral nerves to the central nervous system resulting in a fatal

encephalomyelitis.⁵ If untreated, it carries a 100% mortality, accounting annually for 40 000–70 000 deaths worldwide.^{6 7}

Rabies prophylaxis is essential in preventing infections, and is extremely effective with 100% success rates in those immunised pre-exposure and postexposure. Nearly 4 million people are vaccinated with this every year.⁶

The vaccine is the inactivated human diploid cell strain (HDCS) virus and individuals require several doses. There have been reports of post rabies vaccination neurological complications, ranging from Guillian-Barré syndrome and facial paralysis to demyelinating encephalitis.^{8 9}

There are three forms of the vaccine licensed for use in the UK—HDCS: Imovax; purified chick embryo cell vaccine: Rabipur/RavAvert; and purified vero cell rabies vaccine: Verorab. These tend to be given as three injections 7 days apart, although different regimens have been reported.¹⁰

Commonly recognised side effects of rabies immunisation include localised pain and erythema (30–74%) at the site of injection. Reported systemic side effects due to rabies vaccines include headache, cough, abdominal pain, myalgia, weakness and, less frequently, urticaria, angio-oedema, fever and anaphylaxis.¹⁰ In this case, no other aetiological factors for the SSNHL could be found, so it was concluded to be a complication of rabies immunisation.

Figure 2 Pure tone audiogram on day 12 after completion of prednisolone (60 mg).

Figure 3 Pure tone audiogram on day 26 after completing the course of intratympanic steroid injections.

We could find a single other report of this in the literature.⁵ In that case, a child presented with sudden onset unilateral severe hearing loss, tinnitus and vertigo, 1 day after getting his first rabies immunisation (right ear hearing thresholds of 82 dB). Unlike our case, this was initially treated with intravenous methylprednisolone followed by a short course of oral prednisolone and the child received his second dose of rabies immunisation. The patient's hearing initially improved, but he was lost to follow-up, re-presenting 2 months later with profound hearing loss in the right ear. He was treated again with methylprednisolone and oral steroids for 10 days, with improvement to 22 dB hearing at 6 months. No IT steroid therapy was used.

The aetiology for this remains unclear.⁵ Following immunisation, the viral antigen will trigger an immune response causing the release of antibodies and cytokines and, subsequently, results in formation of immunological memory. During this event, the potential for hypersensitivity reactions exists. Immunocomplex-mediated reactions can result in an autoimmune response, and it is possible that antibodies can be directed towards the cochlea itself. In this case, the patient's pre-existing history of atopy may have increased the likelihood of a rapid autoimmune response.

Autoimmune disorders of the inner ear, although rare, are a recognised entity.^{11 12} However, they differ in their presentation from the case we describe here, typically occurring over a period of weeks to months, usually progressive, and are frequently bilateral and can cause irreversible damage.¹² They are analogous to glomerulonephritis in that inner ear inflammation progresses rapidly over months to cause irreversible damage.

Diagnostic assays aimed at identification of an anticholesteric antibody response have been inconsistent in the literature.^{13 14} It is felt that anticholesteric antibody (also called anti-HSP-70) tests lack sufficient sensitivity and specificity to be used as reliable diagnostic tools.¹⁵ Antibodies to HSP-70 can also be found in patients with Lyme disease, malignancy and Ménière's disease, but also in about 5% of healthy individuals.^{13 14} In the case we report, the patient had a positive anti-HSP-70 titre with a negative ANA screen, which is likely to be of little diagnostic significance.

The management principles in treating these patients are similar to those for any other cause of SSNHL and must include a multidisciplinary team approach. The first-line treatment advocated is the use of oral corticosteroids.¹¹ Salvage IT steroid injections are recommended in cases of SNHL with no improvement following systemic corticosteroid therapy.¹

This is the first case of post rabies vaccination SSNHL in an adult and the first to be treated with IT steroid injections. Although we were unable to salvage further hearing in our case, we still consider this an appropriate treatment modality in such patients with persistent hearing loss despite a course of oral corticosteroid. Furthermore, if the rabies vaccination is administered following an exposure to rabies, this method of targeted drug delivery to the cochlea minimises systemic absorption and therefore would not interfere with immune response and the antibody titre generated.

CONCLUSION

In conclusion, we describe a rare case of SSNHL following rabies vaccination. This clinical entity requires prompt diagnosis and management. A thorough drug history is essential to identify any possible recent exposures that may be responsible. We advocate salvage IT steroid injections in cases where SSNHL is refractory to initial systemic corticosteroid therapy. Tinnitus and vertigo can also be very distressing sequelae and input from audio-vestibular physicians plays a key role in symptomatic control.

Learning points

- ▶ Sudden onset sensorineural hearing loss is a rare complication of rabies immunisation.
- ▶ Initial management should follow that of any case of SSNHL.
- ▶ Salvage intratympanic steroid injections may be beneficial if given promptly and in cases resistant to oral corticosteroid therapy.
- ▶ Diagnostic assays are of little additional clinical benefit in these cases.
- ▶ A thorough drug history in every case of SSNHL is essential in order to identify any recent exposures that may be responsible.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

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