Sudden hearing loss after an explosion

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Mohamad I, Md Daud MK. Sudden hearing loss after an explosion. Malays Fam Physician 2013;8(3);51-3

Keywords:
hearing loss, sensorineural, explosion

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Case History

An 18-year-old man presented with a sudden onset of bilateral hearing loss after a home-made firework exploded near the right side of his scalp. The hearing loss was associated with tinnitus. Examination revealed an area of skin loss on the right pinna. There was mild bleeding from the right pinna and scalp at the mastoid region, which spontaneously resolved. An otoscopic examination is shown in Figure 1.

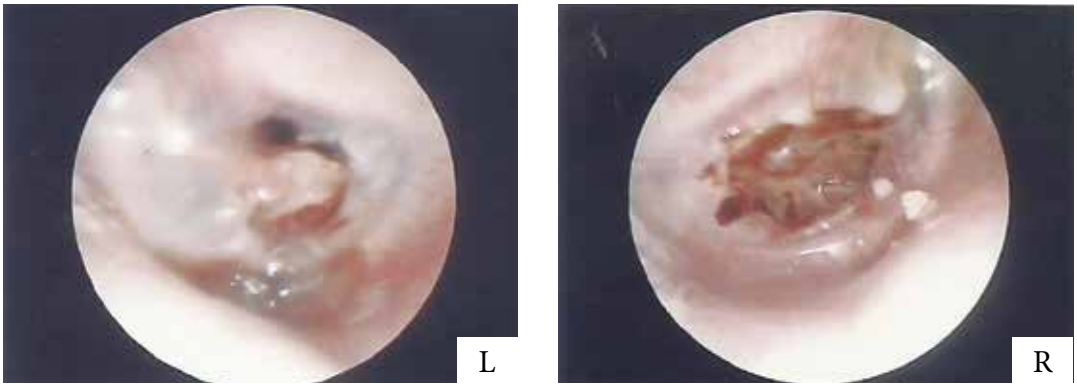

Figure 1.

Questions

1. Describe the abnormalities of the tympanic membranes in Figure 1.
2. What further ear examination should be performed in this patient?
3. What is the most likely diagnosis?
4. What are the features that differentiate perforation due to infection?
5. Outline the management for this patient.

Answers

1. The otoscopic examination revealed bilateral tympanic membranes (TM) perforation with jagged edges. The perforation was larger on the right side. Blood clots were found medial to the ruptured TM. Such changes in the TM are reported to be in around 15% of blast-exposed patients.[1] It should be suspected, detected and documented in every blast-explosive acoustic trauma. Besides hearing loss (HL) due to blast injuries, a blow (e.g a slap to the ear) can result in similar features of TM perforations.[2,3]

2. A tuning fork test is used to assess the type of hearing loss, whereas a pure tone audiometry (PTA) should be done to confirm and document the type and severity of the HL. In this case, PTA was consistent with profound right HL and severe-to-profound left HL, with features of mixed HL in at least in one ear (Figure 2). In this PTA, bone conduction had only been done on the left ear as the patient was having scalp injury around the right pinna and mastoid. Unfortunately, as the attenuation for bone is zero, the PTA will detect the best cochlea. The result for the best cochlea was thus shown on the PTA, but we could not confirm which side of the ear. That is why the conclusion was "mixed HL in at least one ear". The effects of the explosive acoustic trauma also can be shown via a measurement of otoacoustic emissions (OAE).[4] OAE check the movement of outer hair cells. Following the explosion, the hair cells may be damaged, causing disruption of the production of OAE.

3. The diagnosis is bilateral TM perforation, secondary to acoustic trauma. Acoustic trauma is an injury to the inner ear due to loud noise exposure. It can occur following an acute loud noise near the ear or after prolonged exposure to loud noise, such as working in a noisy environment.[5] In this case, besides the sensorineural HL, the trauma also caused TM perforation. Tinnitus is a common accompanying symptom.

4. In traumatic instance of TM perforation, the edges will appear jagged. Blot clots will also be present. In infective TM perforation, such as chronic suppurative otitis media, the edges would appear smooth. This documentation of otoscopic findings is important during the initial or early otoscopic inspection, especially in medico-legal cases.

5. The patient was treated with intravenous antibiotics, steroids and analgesics. A steroid is used in this case to reduce acute nerve injury (oedema). After two weeks, the left TM showed complete healing while a residual 20 percent of the perforation was noted on the right side (Figure 3). A repeat PTA showed mild conductive HL in the right ear and normal hearing level on the left ear, except for high (4kHz) frequencies (Figure 4a - 2 weeks after treatment, Figure 4b - 6 months after treatment). According to the histological study of cochlear outer hair cells, the frequency range between 1.0 and 4.0 kHz are most susceptible to extensive damage following explosive acoustic trauma.[4]

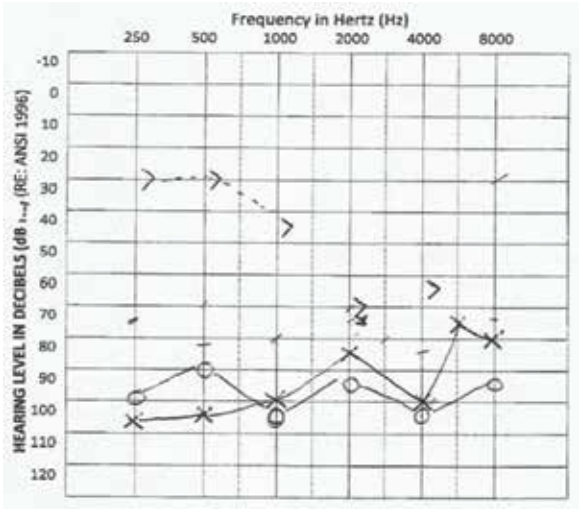

Figure 2 (Legend: 0-unmasked right air conduction, X-unmasked left air conduction, >-unmasked left bone conduction)

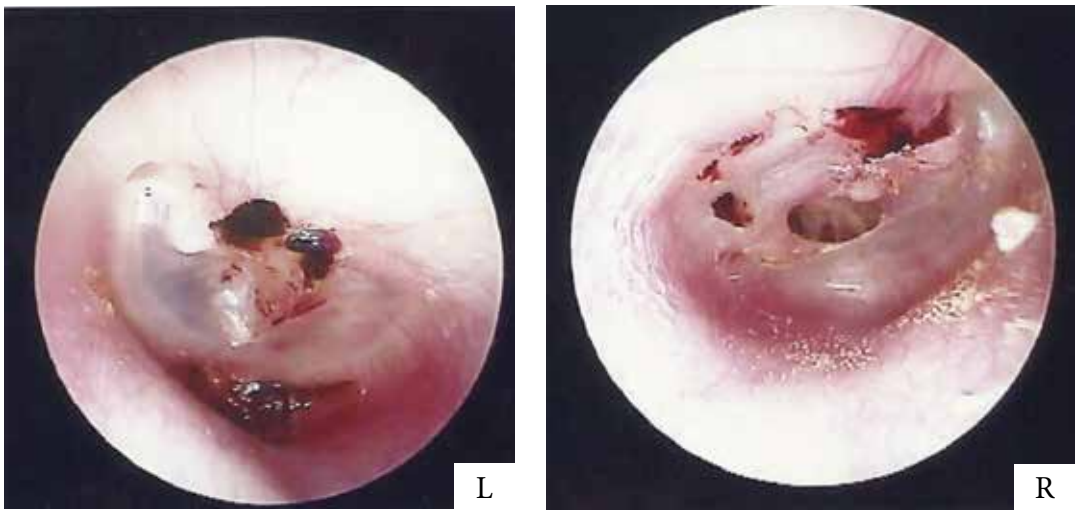

Figure 3

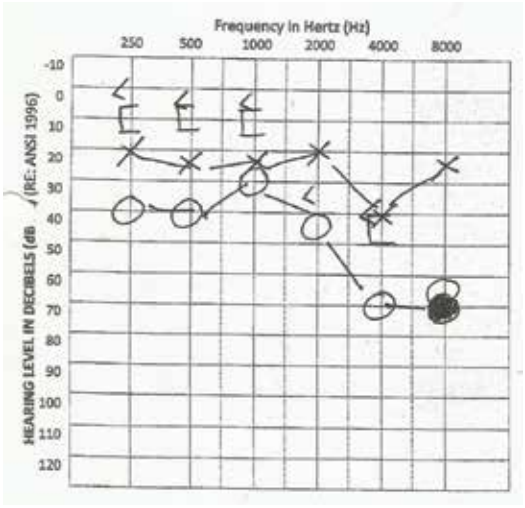

Figure 4a (PTA 2 weeks after treatment) (Legend: filled 0 – masked right air conduction, < - un-masked right bone conduction, [- masked right bone conduction)

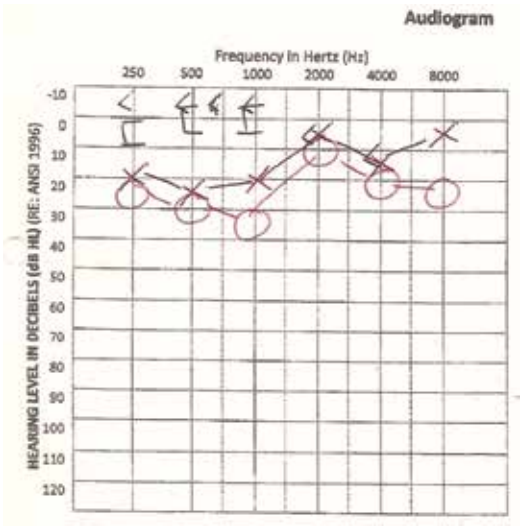

Figure 4b (PTA 6 months after treatment)

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