Case Report

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Airbag Deployment And Tinnitus Emergence Following Car Crash, a Case Report And a Brief Literature Review

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ABSTRACT

Automatic airbag deployment during car accidents undoubtedly plays a vital role in preventing injuries. However, it may occasionally lead to aural damage, including noise-induced hearing loss, tympanic membrane perforation, and tinnitus. Here, we present a case of left curtain airbag deployment immediately following a low-speed car accident, which resulted in the driver experiencing tinnitus. In addition to the case presentation, we have included a brief literature review on potential otologic and non-otologic injuries caused by airbags

Introduction

According to the World Health Organization, the annual mortality and morbidity of road traffic crashes worldwide are approximately 1.19 million and between 20 and 50 million, respectively. Motor vehicle airbags and seat belts are essential protective devices that enhance the safety of car occupants and drivers from potential injuries during car accidents [1]. Car airbags, designed and manufactured in early 1976 [2], are now prevalent in modern cars worldwide. There are several types of airbags, including side, front, and knee airbags, as well as inflatable seat belts. For passengers in back seats, a rear-window curtain is designed for rear-end crashes, while far-side airbags protect the driver and front-seat passenger from colliding with each other. Airbags, which automatically inflate during car crashes, may cause ear injuries such as tympanic membrane perforation, resulting in conductive hearing loss, noise-induced sensory neural hearing loss (SNHL), and tinnitus due to exposure to loud explosive sound. Non-otologic injuries may also occur.

Presented here is a case of prolonged tinnitus following the deployment of a left airbag curtain after a low-speed car crash, along with a review of the

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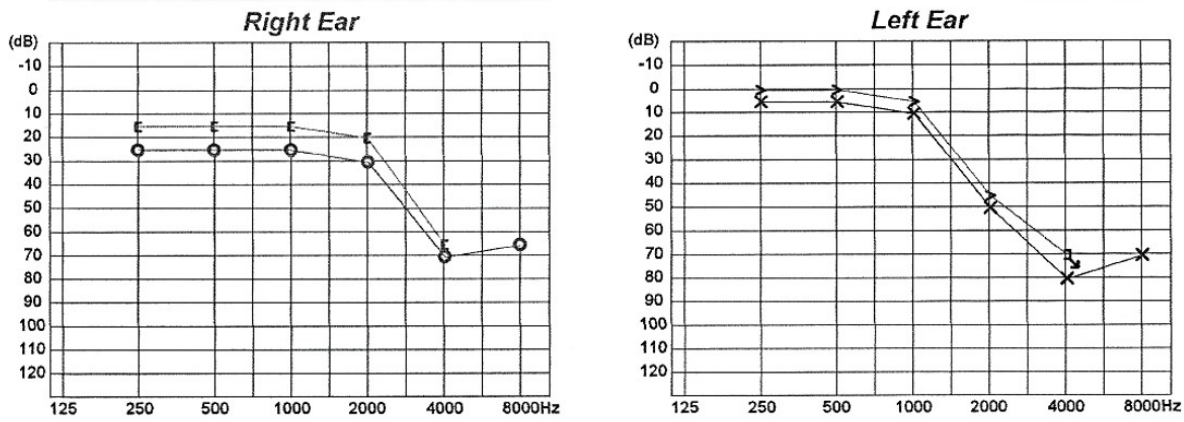

Fig. 1. PTA of the patient

literature to highlight the potential damages caused by car airbags.

Case report

A 77-year-old man was referred to our private ENT clinic, complaining of continuous whistle-like tinnitus in his left ear. This condition occurred after he experienced a low-speed car crash and a sudden deployment of the left side curtain airbag, which generated intense noise. He had no history of ear problems in the past and no systemic disorders. Upon otologic examination, impacted hard earwax was found in the left ear canal, obscuring the tympanic membrane. To visualize the tympanic membrane, the left earwax was removed. The left tympanic membrane, once visible, was found to be intact. The right ear and other ENT examination findings were unremarkable. Pure tone audiometry (PTA) was performed. The patient's audiogram showed bilateral high-frequency SNHL, with the maximum at 4000Hz (Fig.1). The pre-injury hearing level was unknown. On follow-up, the tinnitus remained unchanged after four months.

Discussion

In the recently presented case, the driver noticed a sudden onset of tinnitus in the left ear after a low-speed car crash. The deployment of the left curtain airbag resulted in the generation of intense sound. However, the left tympanic membrane remained intact. In fact, the impacted earwax in the left ear canal may have protected the eardrum by reducing the intensity of the sound.

Generally, there are two categories of potential harmful effects of airbags: otologic injuries due to airbag deployment and loud sound generation, and other harmful impacts due to the direct trauma of the inflated airbag to various body parts. In 1976, an investigation was published on the potential safety of airbags, and ten adult and infant squirrel monkeys were used as experimental subjects. The investigators evaluated the cochlear nerve action potentials in both subjects' ears before the blast, immediately post-blast, and several weeks later. At that time, the researchers concluded that no permanent hearing injury, tympanic membrane perforation, middle ear ossicular chain disruption, and inner ear loss of hair cells would occur due to airbag deployment at velocities up to 100 mph and a sound intensity level of 150 dB [4]. Subsequently, in other studies, the generated sound pressure level of airbag deployment after a car crash was mentioned to be between 150 and 170 dB, which was generated in less than 100 ms [3], and the greatest hearing loss was observed at 4000Hz [2]. Sound is expressed in decibels on a logarithmic scale. The maximum safe level of sound pressure is below 85 dB. For comparison, a jet taking off generates 130 dB, which is harmful, while normal conversation is 60 dB and is considered a safe level [5].

In 1998, the first documented report on associated otologic problems following motor vehicle accidents and airbag deployment, between 1985 and 1998, was published. It included the aural symptoms of 20 patients. In 85% of the cases, hearing loss and tinnitus were the most prevalent symptoms. Also, in 50% of the patients, disequilibrium was reported. In a review of the literature from 1991 to 1998, 44 articles were identified in which the investigators described 97 patients with ocular injuries associated with airbag deployment during a motor vehicle accident [5]. In another report, in a rear-end car collision, a patient developed unilateral hearing loss and tinnitus, as well

as a nasal bone fracture with frontal impression of the bony nasal structure. The other car passenger also developed skin burns because of the leaking filling gas of the airbag [2].

In 2011, Halleman et al. investigated the blunt lateral impact and thoracic injury due to side airbag deployment. The aim of their study was to describe the relationship between crash severity, injury mitigation, and occupant distance in blunt thoracic impact with a side airbag [6]. Aortic transection following airbag deployment has also been reported [7]. Other reported injuries, as described by M.F Popa et al., included dermatologic damages in 7 to 8% of cases such as skin contusion or abrasion of the head and face, irritant dermatitis, chemical and thermal burns, and traumatic injury of the wrist and forearm due to the sudden expansion of an inflated airbag [8]. A death was also reported in 2023, in a 37-year-old male due to a faulty airbag system during a moderate-speed car crash [9]. A case of an elderly woman who died because of a retropharyngeal hematoma and airway compromise in a minor motor vehicle collision and the deployment of her airbag is reported [10].

Conclusion

Healthcare professionals and the general public should be aware of potential injuries caused by airbags, despite studies showing that airbags can significantly reduce morbidity and mortality in car crashes.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this article.

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Conflict of Interests

The authors have no conflict of interest to declare.

Contribution of authors

MHA: data collection, and writing and editing the manuscript. FA: performed PTA. Authors read and approved the final manuscript.

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