Transient auditory dysfunction: A description and study of prevalence

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Abstract

Transient auditory dysfunction (TAD) is a previously undescribed symptom complex of unknown cause. It is characterized by short-lasting sensorineural hearing loss (unilateral or bilateral), it is associated with tinnitus, it resolves completely within minutes, and it is not accompanied by vestibular symptoms. We conducted a cross-sectional prospective study to define TAD, find its prevalence, and discuss its significance. Two hundred healthy subjects between the ages of 16 and 49 years were surveyed using a questionnaire. Of these subjects, 41 (20.5%) reported experiencing symptoms of TAD. The mean number of episodes was 5.9 times per month, the mean duration was 41 seconds, and 80% experienced concomitant tinnitus. We conclude that TAD is a common finding in a healthy population. This may have implications for the pathogenesis of sudden-onset sensorineural hearing loss. Further longitudinal studies and detailed audiologic evaluation of patients with TAD are required to ascertain the significance, etiology, and pathophysiology of this condition.

Introduction

Sudden-onset hearing loss is a well-recognized condition defined as a 30-dB hearing loss developing within 3 days. In most patients the etiology is unknown.[1] The incidence is low, between 5 and 20 per 100,000 per year, although this is likely to be an underestimate.[2] Most patients recover their hearing completely. Although recurrent episodes of hearing loss can occur, this is unusual (14 out of 1,798 patients in one study[3]).

The senior author (D.R.) has noted short-lasting episodes of unilateral hearing loss in himself on one or two occasions per month, developing over approximately 30 seconds and resolving within a minute. The episodes are associated with unilateral tinnitus but no vestibular symptoms. He has noted that many healthy people, when asked, have described similar symptoms. To our knowledge there is no previous description of a common, transient, recurring hearing loss in the literature. We have used the term *transient auditory dysfunction* (TAD) to describe it.

We aimed to define TAD, investigate its prevalence in otologically healthy subjects, and study its characteristics and associated symptoms. We also discuss its significance in relation to sudden sensorineural hearing loss (SSHL).

Subjects and methods

Based on a previous pilot study (unpublished), 241 subjects between 16 and 49 years of age were selected at random from the employees and medical students at University Hospital, Coventry. The purpose of the study was explained to the participants, and consent was obtained.

For each subject the following information was ascertained: age, sex, medical history (including prior otologic disorders), and drug history. Subjects with a history of otologic problems, significant medical history, or who were on any regular medication were excluded from the study. Next, the researchers read a statement to the subjects that briefly described the symptoms of TAD. For the purpose of this study these were defined as "recurrent episodes of unexplained hearing loss that commence and completely resolve within a few minutes."

If a subject acknowledged previously having experienced these symptoms, further information was obtained regarding frequency, duration, laterality, and estimated percentage of total hearing loss. Finally, subjects were asked if they had experienced any other concomitant symptoms such as tinnitus, vertigo, or otalgia.

The results were tabulated for analysis. The proportion of subjects who experienced symptoms of TAD was noted, and the demographic details for these subjects were compared to those of the whole population. For the group that experienced TAD, the mean frequency, duration, laterality, and estimated percentage of total hearing loss were calculated.

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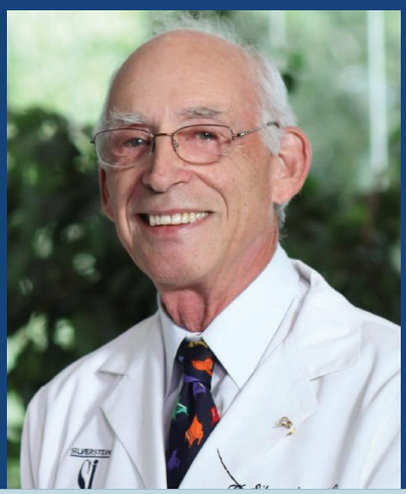

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Statistical analysis was carried out to ascertain the standard error associated with the percentage of our population that experienced symptoms of TAD. From this a 95% confidence interval was calculated to reflect the true prevalence of TAD in the healthy population.

Results

Of 241 subjects who were questioned, 200 met our inclusion criteria. The mean age of the subjects was 31 years, and 91 (46%) were male. Forty-one subjects (20.5%) reported suffering from symptoms of TAD. The mean age of this group was also 31 years, and 19 (46%) were male.

The number of episodes ranged from one per day to one per month, with a mean frequency of 5.9 episodes per month. The duration of a single episode (from first recognizing a decrease in hearing to complete recovery of hearing) ranged from 5 seconds to 5 minutes, with a mean duration of 41 seconds. The magnitude of subjective maximal hearing loss during an episode ranged from 5 to 100% of total hearing, with a mean loss of 36%.

Of the subjects who described experiencing symptoms of TAD, 48% stated that both ears were always affected at the same time, 30% claimed that the symptoms occurred consistently on only one side and, for the remaining 22%, the laterality of each episode was variable and symptoms could be unilateral or bilateral.

Eighty percent of subjects experienced concomitant tinnitus in the affected ear. No vertigo or other symptoms were associated.

Discussion

We have described TAD, a previously undescribed symptom complex of transient hearing loss and tinnitus that resolves rapidly and recurs frequently. Its prevalence is high at 20.5% (with a range of 11.4% to 29.6% using a 95% confidence interval).

We studied healthy subjects aged 16 to 49 to reduce the likelihood of coexistent presbyacusis or other degenerative processes causing similar otologic symptoms. Although this sample is not large, it has demonstrated a sufficiently large prevalence to indicate TAD is common in a healthy population.

Because of the transient nature of the hearing loss in TAD, it has not been possible to audiologically evaluate the nature of the hearing loss. It is likely that the hearing loss is sensorineural because of the high rate of coexistent tinnitus.

A number of recognized conditions are known to cause hearing loss. In most of these the exact etiology and pathophysiology are poorly understood. SSHL has been defined as a 30-dB hearing loss over 3 contiguous pure-tone frequencies.[4] Onset may be sudden or may develop over several days. Estimated incidence is 5 to 20 cases per 100,000 people per year, peaking in the 40s, and affecting the genders similarly.[4] The majority of cases are unilateral, with bilateral cases occurring in just 1 to 2% of people.[4] The rate of complete recovery in SSHL is estimated to be only 25%, with a further 50% having partial recovery and 25% no improvement of symptoms.[5] This contrasts with TAD, in which the prevalence is high, symptoms are bilateral in nearly half of cases, and in all cases hearing is recovered completely.

Four pathophysiologic mechanisms for SSHL have been postulated. The first is viral infection of the labyrinth. Many patients recall a recent viral infection, although this is to be expected, since the incidence of viral infections is high in the general population. More convincing evidence includes a significantly higher rate of seroconversion for the herpesvirus family in people with SSHL compared to controls.[6]

The second mechanism postulated is labyrinthine vascular compromise, which is supported by the suddenness of onset. The cochlea is an end-organ with no collateral blood supply. One study showed associations between SSHL and smoking, elevated fibrinogen, and with the GP1a C807T polymorphism—all factors predisposing to coronary disease.[7]

The third mechanism postulated is rupture of the intracochlear membrane, illustrated in 2 cases by Gussen.[8] The fourth mechanism may be via immune-mediated disease of the inner ear.

TAD cannot be easily explained by any of the above mechanisms, mainly because the duration of TAD is short and it recurs regularly.

Classic Ménière disease is characterized by hearing loss, vertigo, tinnitus, and pressure that last minutes to hours. Its pathophysiology is not fully understood, although it is known that endolymphatic hydrops occurs.[9] TAD's short duration and the absence of vestibular symptoms is evidence against its being a Ménière disease variant. However, Ménière's sudden onset and timescale of symptoms, and their propensity to recur, are more similar to TAD's features than to those of SSHL.

King-Kopetzky syndrome, also known as *obscure auditory dysfunction* (OAD), is described as gradual subjective hearing loss with a normal pure-tone audiogram. There is some evidence that the problem arises from defective auditory processing.[10] Patients report difficulty hearing speech, particularly in the presence of background noise. TAD's features are dissimilar to those of OAD, suggesting a different pathophysiology.

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The relatively high prevalence of TAD indicates that sensorineural hearing loss may be much more common than previously described, but in most cases of TAD, the condition is short-lasting and benign. It is possible that in a minority of cases, the hearing loss is more severe and long-lasting, developing into SSHL. The arbitrary definition of SSHL excludes patients with symptoms of TAD. This exclusion, however, may be artificial, with the pathophysiologic process in TAD and SSHL being the same but more extreme in the latter.

The various previously proposed mechanisms of sensorineural hearing loss listed above are unlikely to be relevant to TAD. A new pathophysiologic mechanism is required to explain this condition. Possible candidates could include a neurologic dysfunction, such as occurs in trigeminal neuralgia or epilepsy, which are sudden transient processes. Another mechanism might be temporary immobility of the ear drum or ossicles caused by an accumulation of mucus. Understanding the pathophysiology of TAD may also have relevance with respect to tinnitus. Many patients with tinnitus also describe its onset as sudden.

Further studies are required to assess the pure-tone audiograms of subjects with TAD. Ideally, this could be carried out during an episode of hearing loss, but for practical reasons, this may be difficult. Further studies are also required to determine the possible pathophysiologic mechanism behind TAD. A longitudinal study is required to ascertain the clinical significance of this disorder and to determine whether subjects with TAD are more likely to develop sensorineural hearing loss or tinnitus.

References

1. Lazarini PR, Camargo AC. Idiopathic sudden sensorineural hearing loss: Etiopathogenic aspects. Braz J Otorhinolaryngol 2006;72(4): 554-61.
2. Olzowy B, Osterkorn D, Sückfull M. The incidence of sudden hearing loss is greater than previously assumed [in German]. MMW Fortschr Med 2005;147(14):37-8.
3. Furuhashi A, Matsuda K, Asahi K, Nakashima T. Sudden deafness: Long-term follow-up and recurrence. Clin Otolaryngol Allied Sci 2002;27(6):458-63.
4. Mathur NN, Meyers AD. Sudden hearing loss. http://emedicine.medscape.com/article/856313-overview. Last accessed June 28, 2013.
5. Vasama JP, Linthicum FH Jr. Idiopathic sudden sensorineural hearing loss: Temporal bone histopathologic study. Ann Otol Rhinol Laryngol 2000;109(6):527-32.
6. Wilson WR. The relationship of the herpesvirus family to sudden hearing loss: A prospective clinical study and literature review. Laryngoscope 1986;96(8):870-7.
7. Rudack C, Langer C, Stoll W, et al. Vascular risk factors in sudden hearing loss. Thromb Haemost 2006;95(3):454-61.
8. Gussen R. Sudden hearing loss associated with cochlear membrane rupture. Arch Otolaryngol 1981;107(10):598-600.
9. Merchant SN, Adams JC, Nadol JB Jr. Pathophysiology of Meniere's syndrome: Are symptoms caused by endolymphatic hydrops? Otol Neurotol 2005;26(1):74-81.
10. Zhao F, Stephens D. Distortion product otoacoustic emissions in patients with King-Kopetzky syndrome. Int J Audiol 2006;45(1):34-9.

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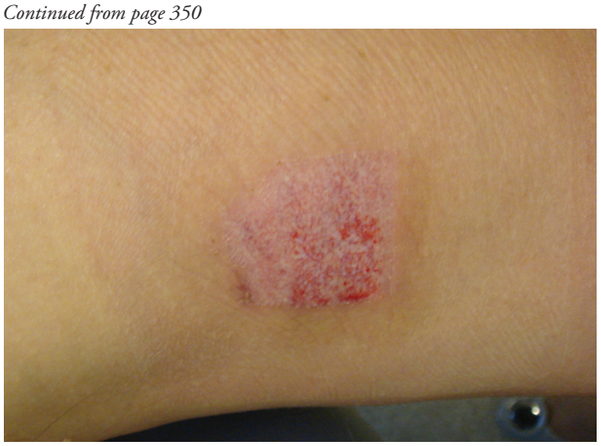

Figure 4. Photo shows the appearance of the donor site 8 days after harvesting. Petroleum jelly and a light dressing have been applied to the wound.

Postoperative otorrhea and patchy mucosalization are commonly encountered after otologic surgery, but the Thiersch graft procedure significantly reduces the incidence of these problems. Otorrhea after a Thiersch graft rarely lasts longer than a week. Graft survival rates are also very high, as failures are generally observed only in cases where the underlying recipient vascular bed was inadequate.

No donor-site complications have been observed in our practices during the past 5 years in more than 120 cases.

Conclusion

Thiersch grafting is a highly effective adjunct procedure in otologic surgery. This article serves to reintroduce this technique as a useful part of the otologist's surgical repertoire. We routinely use these partial-thickness skin grafts after otologic procedures that either create a mastoid cavity or result in reduced skin coverage of a portion of the external auditory canal.

Thiersch grafting reduces the incidence of postoperative otorrhea. A key to successful skin grafting is to perform the procedure about 10 days after the primary procedure to allow sufficient time for the formation of an adequate vascular bed at the recipient site that provides the blood supply to the skin grafts. The goal in all cases is to achieve a safe, dry ear covered by keratinizing squamous epithelium. The Thiersch graft accomplishes this very well.

References

1. Thiersch C. Ueber die feineren anatomischen Veränderungen bei Aufheilung von Haut auf Granulationen. Verh Deutsch Ges Chir 1874;3:69-75.
2. Sajjadi H. Thiersch skin grafting and postoperative care of otologic patients. Otolaryngol Clin North Am 1999;32(3):597-608.