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The risk of stroke in patients with sensorineural hearing loss

Athina Zarachi [1, *], Angelos Liontos [2] and Litsou Eleni [1]

[1] *Department of Otorhinolaryngology, Head and Neck Surgery, School of Health Sciences, University Hospital of Ioannina, University of Ioannina, Ioannina, Greece.*
[2] *Department of Pathology, Faculty of Medicine, School of Health Sciences, University of Ioannina, Ioannina, Greece.*

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Abstract

Purpose: to provide a comprehensive analysis of the relation between stroke and sensorineural hearing loss.

Methods: An extensive review of the international bibliography has been performed on the risk of stroke in patients with sudden sensorineural hearing loss.

Results: There is a growing number of reports on the risk of stroke in sudden sensorineural hearing loss.

Conclusions: Clinicians should always suspect and associate the SSNHL with the risk of stroke.

Keywords: Sudden Sensorineural Hearing Loss; Stroke; Risk of Stroke; Deafness

1. Introduction

Stroke is a primary factor contributing to disability and death. The worldwide lifetime risk of experiencing a stroke for individuals aged 25 years or older is 24.9%(1). Hearing loss ranks as the third most prevalent chronic condition globally, following arthritis and hypertension(2). Sensorineural hearing loss (SNHL), commonly referred to as 'nerve-related hearing loss', is defined as hearing loss caused by damage to hair cells in the cochlea, spiral ganglia, cranial 8th nerve (auditory nerve), or the central auditory processing centers of the brain(1).

While the exact cause of sudden sensorineural hearing loss (SSNHL) is often unclear, past research has indicated that it may be linked to viral or bacterial infections, inner ear membrane rupture, vascular issues and autoimmune conditions (3-6). Vascular diseases have recently garnered significant interest as a potential etiology of SSHL (7, 8). Recent cohort studies have shown an increased risk of stroke in individuals with sudden sensorineural hearing loss compared to the general population (8-20).

2. Methods

A comprehensive electronic search was performed to identify articles pertaining to the risk of stroke in patients with SNHL. review was limited to published articles using PubMed, Google Scholar and Scopus Library. We employed a range of English keywords such as: “stroke”, “sensorineural hearing loss”, “sudden sensorineural hearing loss”, “ischemic stroke”, “acute ischemic stroke”, “ischemic stroke pathophysiology”, “acute hearing loss” “cerebellar ischemic stroke”, “risk of stroke”, “deafness in stroke”, “sudden deafness as a sign of stroke”, “stroke associated deafness”, “hearing disorders in stroke”, “auditory disfunction is stroke”, “. The authors removed duplicates and selected articles related to the topic.

* Corresponding author: Athina Zarachi.

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3. Results

There is a growing number of reports on the risk of stroke in SNHL. Research indicates that sudden sensorineural hearing loss has a vascular cause. Therefore, sudden sensorineural hearing loss (SSHL) may be associated with a vascular event, such as a slight injury to the cochlea(21). The inner ear is highly susceptible to ischemia. Research discovered a significant prevalence of cardiovascular risk factors in individuals with SSHL, maybe due to microvascular dysfunction contributing to stroke. Cochlear hair cells are believed to have significant metabolic activity and are exclusively nourished by the ending spiral modiolar artery, a branch of the anterior inferior cerebellar artery, which is notably susceptible to ischemia(22).

4. Discussion

Masoud Khosravipour & Fatemeh Rajati in their systematic review and meta-analysis showed that there is a significantly increased stroke risk in patients with sudden sensorineural hearing loss (SSNHL) compared to age-related hearing loss (ARHL). Their study also revealed that individuals with sensorineural hearing loss (SNHL) have a greater likelihood of experiencing a stroke compared to those without SNHL(1).

Individuals with sudden sensorineural hearing loss (SSNHL) who also had additional health conditions such as kidney illness and vertigo were found to have a significantly increased likelihood of experiencing a stroke. Furthermore, there was no statistically significant difference between males and women in the incidence of stroke. However, being male raises the risk of stroke by up to 47%(1).

Considering the etiology od SSNHL, we found that most of the risk factors for sudden sensorineural hearing loss (SSNHL) described in the literature are associated with the cardiovascular system, as changes in blood flow through the labyrinthine artery might potentially harm the inner ear. The labyrinthine artery is crucial for supplying blood to the inner ear. However, the absence of alternative blood flow increases the vulnerability of the labyrinth to ischemic events. Thrombosis, hemorrhage, and vasospasm can cause inner ear artery flow interruption(23, 24). Tagaya et al. in their study examined the magnetic resonance imaging (MRI) findings of patients with sudden sensorineural hearing loss (SSNHL) using a three-dimensional, fluid-attenuated inversion recovery technique. The study found that patients with SSNHL showed high signals in the affected inner ear four hours after receiving intravenous gadolinium injection. These high signals may indicate minor hemorrhage or a disruption in the blood-labyrinthine barrier(25). Lin et al. discovered that the likelihood of experiencing a stroke was 1.6 times greater among individuals with sudden sensorineural hearing loss (SSNHL) compared to control patients(4). Lee et al. discovered that 33.3% of the patients experienced a brain ischemia event within a time frame of 1 day to 2 months after acquiring sudden sensorineural hearing loss (SSNHL)(26). Cochlear hair cells are believed to possess significant metabolic activity and rely exclusively on the terminating spiral modiolar artery for their blood supply. This artery is a branch of the anterior inferior cerebellar artery and is particularly susceptible to ischemia(27, 28).

Tsuzuki et al. through their investigation concluded that individuals with grade 3-4 hearing loss severity had a greater likelihood of exhibiting elevated risk factors for stroke and atherosclerosis(29). Zhong et al. proved that there is a strong link between bilateral SSNHL and the possibility of an ischemic stroke, emphasizing the significance of standardized hearing examination in clinical practice(30). Kim et al. found an elevated risk of ischemic stroke following SSNHL, after matching 4.944 SSNHL participants with 19.776 controls. This risk was greater during the 3-year-follow-up period compared to the 5-year-follow-up(12). Kuo et al. in their research revealed a low incidence rate of SSNHL in stroke patients at 1.19 per 1000 patient-years. Nevertheless, studies have found that around 60% to 80% of individuals who have experienced a stroke also have hearing impairment(31). Fang et al. comprised a total of 19,238 participants in their study, trying to examine the correlation between hearing loss and the risk of stroke in the middle-aged and elderly population of China. They concluded that as the severity of hearing loss increases, the risk of stroke has also been observed to increase gradually(8). Lee in his review mentioned that SSNHL is a significant indicator for diagnosing AICA area infarction and can often serve as an early warning sign for imminent vertebral basilar insufficiency syndrome (VBIS)(18). Lee et al. mentioned that SSHNL is present in around 10% of posterior circulation ischemic strokes(32).

5. Conclusion

Traditionally, acute hearing loss has been considered a sign of stroke that has not been adequately addressed and has been underestimated. However, if a stroke happens in the vertebrobasilar circulation, it can lead to sudden sensorineural hearing loss (SSNHL). This is explained by the fact that the auditory system relies on this system for its blood supply. Moreover, approximately 10% of vertebrobasilar ischemic strokes (VBIS) are associated by acute hearing

loss (AHL). At times, sudden sensorineural hearing loss (SSNHL) can act as a sign of an impending vestibular schwannoma (VBIS), especially in the anterior inferior cerebellar artery. In such situations, and if the MRI findings show no abnormalities, the doctor must rely on other clinical criteria to make the diagnosis. Clinicians should always suspect and associate the SSNHL with the risk of stroke, and base treatment planning and patient follow-up on this consideration.

Compliance with ethical standards

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"I, Athina Zarachi, the corresponding author of the article entitled "The risk of stroke in patients with sensorineural hearing loss", on behalf of all authors of this work

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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