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Lifestyle, Hypertension, Diabetes Mellitus and Hearing Loss in the Elderly – A Review

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Abstract: Age-related hearing loss is called presbyacusis and is common in the elderly. It is believed to be the third most common condition among the elderly after hypertension and arthritis. It is thought to be due to degenerative changes mainly within the cochlea, leading to significant hearing loss. It is a diagnosis of exclusion, generally resulting in a bilateral, symmetric hearing loss with the greatest loss in the high frequencies and producing a "down-sloping" pattern on the audiogram. It is thought of as the incremental sum of many otologic traumas acquired throughout a lifetime, superimposed on the background of an intrinsic ageing process. Of these, noise exposure is not only the most common cause but the one most difficult to separate from the aging process itself. More than 90 percent of all hearing aid wearers have sensorineural hearing loss and the most common causes of sensorineural hearing loss are age related changes, noise exposure, disturbance of inner ear circulation and increased inner fluid pressure or disturbances of nerve transmission. It has also been suggested that lifestyle and medical conditions may paly a role. This article is a review if the role of lifestyle and other factors such as smoking, noise, hypertension and diabetes mellitus in hearing loss in the elderly.
Keywords: Hearing loss, Elderly, Presbyacusis, Lifestyle, Noise, Smoking, Diabetes Mellitus, Hypertension

INTRODUCTION

Hearing is perhaps man's most important sense. Sound constantly surrounds us and informs us about many objects in our environment. Hearing is thus needed for communication, protection from danger and enjoyment of surroundings [1]. Unfortunately, hearing impairment is frequently caused by pathology. Although the impairment is not life-threatening and does not directly restrict physical activity, it can cause severe disability, limiting a person's ability to interact socially with family and friends and to receive and interpret information [2]. It can also interfere with important activities of daily living, including shopping, using public transportation, communicating with health care professionals, tradespeople, and community service providers. When hearing impairment limits a person's ability to function independently, it can result in a need for formal and informal long-term care services [3]. Unfortunately, the disability is different from other disabilities in that it is an invisible handicap and its significant impact on communication and interaction with others sometimes goes unrecognized.

Clinically significant hearing loss is the third most common condition among older adults after hypertension and arthritis [4]. It can range from bothersome to severely disabling, and can cause the older person to become isolated, depressed and may significantly worsen age-related disabilities and dementia [5]. It is thought to be due to degenerative changes mainly within the cochlea, leading to significant hearing loss. The hair cells within the cochlea are generated within the first trimester of development and are then required to survive for the lifetime of the person. Regeneration does not occur after loss of hair cells. As there is little redundancy within the cochlea, with each region in the cochlea transducing a particular frequency of sound, it had been discovered that the loss of any of this small population of cells will have a noticeable effect on hearing [6]. A variety of cochlea lesions have been described as part of age related hearing loss. When considered individually, each of these lesions gives a different clinical and audiological picture. However, a combination of these lesions in the ageing ear results in bilateral sensorineural hearing loss [7].

Presbyacusis, age-related hearing loss, is a diagnosis of exclusion. Generally, presbycusis results in a bilateral, symmetric hearing loss with the greatest loss in the high frequencies. This produces a "down-sloping" pattern on the audiogram [8]. It is thought of

as the incremental sum of many otologic traumas acquired thoughout a lifetime, superimposed on the background of an intrinsic ageing process. Of these, noise exposure is not only the most common cause but the one most difficult to separate from the aging process itself [9]. More than 90 percent of all hearing aid wearers have sensorineural hearing loss and the most common causes of sensorineural hearing loss are age related changes, noise exposure, disturbance of inner ear circulation and increased inner fluid pressure or disturbances of nerve transmission [10]. It has also been suggested that lifestyle and medical conditions may play a role. This article is a review of the role of lifestyle and medical factors such as smoking, noise, hypertension and diabetes mellitus in presbyacusis.

SMOKING

Smoking is associated with lower blood oxygen levels, vascular obstruction, altered blood viscosity, and possibly ototoxicity. But it is not known how much of it impacts the auditory system. There is controversy as to whether cigarettes can really be deemed as a risk factor for the development of hearing loss [11]. However several studies have associated smoking with hearing loss. An association between cigarette smoking and hearing loss among adults has been found in some clinical studies. Men who smoked more than 1 pack per day had worse hearing thresholds at 250 to 1000 Hz than nonsmokers or "light" smokers [12].

Numerous other studies have shown primary tobacco smoke to be associated with a significant risk of hearing loss [13,14]. For example, Cruickshanks et al., in their study, using a population-based cross-sectional study design, reported that current smokers were 1.69 times more likely to have a hearing loss relative to non-smokers [15]. Also, cross-sectional and longitudinal epidemiologic studies on cognitive function in the elderly suggest that smoking is associated with reduced cognitive function [16]. Even former smokers have been found to develop high frequency hearing loss, suggesting that the harmful effects of smoking upon hearing are cumulative and permanent[17].

NOISE

Noise exposure is a well-known cause of hearing loss. It is known that prolonged exposure to harmful levels of noise results in hearing loss. Sociocusis is a term used to describe hearing loss that develops over time after repeated exposures to loud noise from environmental sources. Hearing loss caused by sociocusis includes recreational and environmental noise from loud music, hunting, power tools, and household appliances [18]. The average, otherwise healthy person, will have essentially normal hearing at least up to the age of 60 if his or her unprotected ears are not exposed to high noise levels of 85dB and above [19].

Noise exposure has been linked to the occurrence and severity of presbyacusis. Even though men and women aged 50 to 80 experience hearing loss in the same frequency range, hearing loss increases more rapidly in men than in women. According to some studies, there is a two-fold increase in the speed at which men lose their hearing, when compared to women [20]. It is also known that elderly men have a higher prevalence of hearing impairment than elderly women [21,22]. It has also been reported that average hearing thresholds in men are typically poorer than those of women in the high frequencies and that men exhibit a sharply sloping hearing loss in the moderately severe range in the high frequencies while women exhibit a more gradual sloping hearing loss in the moderate range in the high frequencies [23]. Experts suggest that these different rates are the result of lifelong exposure to loud noise while hunting, serving in the military, or working in farm and factory occupations [2].

An interesting perspective is gained from the study by Rosen, Bergman, Plester , El- Mofty and Satti. They conducted a study in the Sudan and found that those members of the population over 70 years of age did not show any appreciable decrease in hearing acuity as did similar group in the United States of America. Since research studies have confirmed no racial differences in the ability of ears to withstand loud noises, they concluded that the elderly in Sudan had better hearing because the people lived in a relatively noise-free environment [24].

Noise induced hearing loss can be prevented by avoiding excessive noise and using ear protectors such as earplugs and earmuffs [25]. Earplugs are small inserts that fit into the outer ear canal and earmuffs fit over the ear to form an air seal so the entire circumference of the ear canal is blocked, and they are held in place by an adjustable band. There are also campaigns to reduce environmental noise and to protect the ears with personal protective equipment in occupational noise exposure.

DIABETES MELLITUS

In the elderly patients presenting with deafness, 80% may show evidence of disease processes implicated in hearing loss and over 50% of patients presenting with hearing loss may have evidence of previously unrecognized medical disorders[26]. A number of systemic diseases have been suggested as potentially contributing to hearing loss with age. These comprise hypertension, atherosclerosis, hyperlipidemia, metabolic bone disease, diabetes mellitus, hypothyroidism and alzheimer's disease [27].The most frequent causes of vestibular and auditory abnormalities are attributed to dysfunctions in the metabolism of carbohydrates, thyroid affections, supra adrenal, and other different metabolic disorders. Among glucose

metabolism disorders, diabetes mellitus is the affection most commonly related with auditory disorders[28].

According to the National Institutes of Health, hearing loss is about twice as common in adults with diabetes compared to those who do not have the disease [29]. People with diabetes may also show signs of hearing loss at younger ages than those without it [30]. Other studies have also found higher pure tone audiometric thresholds among diabetics, especially elderly ones [31] and changes in central auditory processing measured by Auditory Brainstem Responses [32,33].

Histopathological studies have shown damage to the nerves and vessels of the inner ear of the individuals with diabetes [34]. However, there are different opinions about the pathological changes in the auditory system. It is widely held that diabetic microangiopathy may be responsible for the auditory pathology by directly interfering with blood supply to the cochlea and indirectly through the secondary degeneration of 8th cranial nerve [35]. Atherosclerosis is another possible mechanism, being common in diabetics. It can also contribute to neuropathy, owing to interference with blood supply and consequently the rate of nutrient transfer [36].

Unlike the well established relationship with vision, the statistics of diabetes related hearing loss among diabetics is not well established and the relationship between hyperglycemia and hearing loss is often challenged and the association is considered poor by many. Notwithstanding, the link between diabetes and sensorineural hearing loss however makes intuitive sense, given the documented neuropathic and microvascular complications of diabetes and the complex blood supply of the inner ear. The effects of different variables such as duration of diabetes, blood sugar control, and presence of end-organ damage on hearing loss have however not yet been clarified. The difficulty in identifying the effects of diabetes on hearing has been ascribed to the usual presence of comorbidities, such as hypertension and atherosclerosis, which could also potentially affect hearing[37].

A number of patterns of hearing loss have been described in diabetic patients. In the elderly, aprogressive, gradual bilateral sensorineural loss, affecting especially high frequencies, similar to presbyacusis, but with more severe losses than those expected by ageing is often found [36]. Otjers that have been described include hearing loss in low and medium frequencies [31] and early onset sensorineural hearing loss [38]. An association with unilateral sudden hearing loss has been described but this association has been challenged [39].

HYPERTENSION

Several mechanisms have been proposed for an association between hearing loss and hypertension. Hypertension may facilitate structural changes in the heart and blood vessels[40]. High pressure in the vascular system may cause inner ear haemorrhage[41], which may cause progressive or sudden hearing loss [40]. This circulatory system pathology in hypertension may also affect hearing in a number of ways. One of the vascular physiopathological mechanisms described is the increase in blood viscosity, which reduce capillary blood flow and ends up reducing oxygen transport, causing tissue hypoxia, thus causing hearing complaints and hearing loss in patients [42]. Moreover, arterial hypertension may cause ionic changes in cell potentials, thus causing hearing loss [43].

However, the association between presbyacusis and hypertension has not been well demonstrated as the results of studies have been inconsistent. Some authors have reported a clear association between hypertension and hearing loss [44-46]. A relationship between hearing loss and arterial hypertension has also been observed in the elderly [47,48].

In a study by Rosen et al. carried out among hypertensive patients in the USA, found a correlation between high blood pressure and hearing loss in high frequencies [24]. However, such correlation was not seen by the same authors in a later study carried out with a Sudanese native population. Similarly, Rey et al. tested 59 patients hearing levels with mean age of 75 years and reported a significantly negative relationship with hypertension [49]. Associations have however been found between noise exposure, hearing loss and hypertension with the effects on the blood pressure being more in older population. A severe NIHL was an independent predictor of hypertension in retired metal assembly workers, 64 years or older [50].

SUMMARY AND CONCLUSIONS

The disabilities brought about by difficulty with social interaction, interpreting information, interference with important activities of daily living, and reduction of independence as well as possible consequent isolation and depression that can be brought about by hearing loss in the elderly warrants prompt action to address all precipitating factors.

Some possible factors in the aetiology of hearing impairment in elderly people are not well enough understood to allow effective preventive measures. For example, age-related degeneration, genetic factors, dietary factors and circulatory changes have been implicated as accelerators of deterioration in the auditory system. Yet the specific relationship of these factors to hearing loss is not known, and further research is needed before preventive strategies can be developed [2].

Other possible causes, such as smoking, Diabetes Mellitus and hypertension, with associations that are not so clear can he controlled in other to reduce the risk of hearing loss occurring as a complication. Hearing loss should also be taught as a possible complication in these conditions and good attention to ear care and ear hygeine should be encouraged so as reduce the risk of development of hearing loss or of precipitating it. General healthy lifestyles should be encouraged as well. Good diet, general health and fitness can reduce cardiovascular contribution to hearing loss.

Some factors are however well-demonstrated causes of hearing loss, such as is the case with noise exposure. Exposure to loud noise at any age can cause irreversible sensorineural damage and significant hearing loss. Advocacy for noise legislation should be intensified, and noise control programs and individual noise awareness programs should be encouraged, as should the use of personal protective equipment where noise cannot be avoided.

General ear care factors that should also be promoted include the prompt and adequate diagnosis and treatment of ear infections, avoidance of self-ear claening, avoidance or careful use of ototoxic medication, protective head wear for people at risk to reduce the risk of ear and head injuries. It should also be noted that hearing loss can occur as a symptom of both otological and non-otological disease and every case of hearing loss especially when sudden, should be promptly investigated and adequately treated.

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